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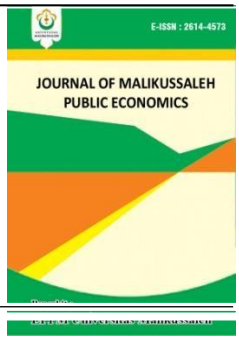
THE INFLUENCE OF HARVESTED AREA, SUGARCANE PRODUCTION, AND INTEREST RATES ON ECONOMIC GROWTH IN INDONESIA



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Sugarcane Production,
Interest Rates, Economic Growth.

ABSTRACT

This study aims to analyze the effect of sugarcane harvested area, sugarcane production, and interest rates on economic growth in Indonesia. The data used in this study are time series data covering a period of 35 years, from 1990 to 2024. The data were obtained from the Ministry of Agriculture and the World Bank and were analyzed using the Vector Error Correction Model (VECM) approach. The results of this study indicate that, in the short run, the harvested area of sugarcane has a positive and significant effect on economic growth in Indonesia, while interest rates have a positive but insignificant effect. Meanwhile, sugarcane production has a negative and significant effect on economic growth in Indonesia. In the long run, the harvested area of sugarcane and interest rates have a positive and significant effect on economic growth in Indonesia, whereas sugarcane production has a negative and significant effect on economic growth in Indonesia.

1. Introduction

Indonesia is classified as a developing country that is currently implementing a planned and gradual development process while continuously emphasizing equitable distribution and maintaining economic stability. National development is directed toward achieving substantial economic growth, which is ultimately expected to improve living standards and enhance the overall welfare of society (Syahputra, 2017).

Economic growth rate is an indicator used to describe and represent the development of a country's economic condition. In practice, the economic growth rate reflects a real increase in the production of goods and services, including the expansion of service sector output and the rise in capital goods production. Economic growth can therefore be defined as a continuous long-term process of increasing per capita output. Consequently, economic growth serves as one of the primary benchmarks for measuring the success of national development, as it plays a crucial role in improving social welfare and enhancing the quality of life of the population. Hence, the higher the level of economic growth achieved by a country, the greater its economic growth rate tends to be (Sukirno, 2015).

According to the classical theory proposed by Adam Smith, as cited in Muhammad (2022) a country can achieve economic growth through the establishment of specialization in the production of goods and services. In this context, specialization enables a country to create added value in comparison with other countries, thereby making its goods and services competitive and suitable for international trade. Economic growth is considered one of the most important indicators in assessing the success of economic development within a country, alongside other indicators such as unemployment rates, poverty levels, inflation rates, and related macroeconomic variables. Rapid and stable economic growth is expected to generate positive impacts, both directly and indirectly, on other economic variables. The following section presents the economic growth rate in Indonesia over the past ten years.

Source: World Bank (2024)

Figure 1.1 Economic Growth Rate of Indonesia, 2015-2024

Based on Figure 1.1, the economic growth rate in Indonesia exhibited a fluctuating pattern over the observed period. From 2015 to 2018, economic growth increased gradually. However, during the 2019–2020 period, economic growth experienced a significant decline, reaching -2.07%. Subsequently, from 2021 to 2022, Indonesia's economy recovered and recorded an increase in growth, reaching 5.3%, before experiencing another slowdown during the 2023–2024 period. The increase in economic growth in 2018 was supported by all sectors of economic activity from the production side, with the highest growth originating from the other services sector at 9.08%. Meanwhile, from the expenditure side, economic growth was driven by all expenditure components, where the expenditure component of Nonprofit Institutions Serving Households (NPISHs) recorded the highest growth at 10.79% (Statistics Indonesia, 2019). In 2020, economic growth experienced a substantial decline as a consequence of the COVID-19 pandemic, which significantly hindered economic activities in Indonesia (Kinski, 2021). By 2024, Indonesia's economy grew by 5.03%, slightly slower compared to the 5.05% growth achieved in 2023 on a year-on-year basis.

Interest rates also play a significant role in supporting economic growth. From an economic perspective, interest rates may be interpreted as the return earned from saving activities. When interest rates increase, households tend to raise the amount of their savings due to the higher potential income generated from interest on deposited funds. Conversely, when interest rates are relatively low, individuals are generally less motivated to save their money in financial institutions. Instead, they tend to allocate their funds toward investment activities considered more profitable, or use them for consumption and business expansion purposes (Sukirno, 2012a).

Interest rates constitute one of the monetary policy instruments established by the government through the monetary authority in order to maintain the stability and sustainability of the national economy. Interest rates play a crucial role in the investment decision-making process, as investors generally expect an optimal rate of return on the funds they invest. An increase in interest rates is often utilized by the central bank as a strategic measure to control inflation. Higher interest rates increase borrowing costs, thereby reducing the amount of money circulating within the economy and potentially slowing economic activity. Conversely, lower interest rates reduce the cost of credit or loans, which can stimulate investment and household consumption, ultimately strengthening overall economic activity.

The following Figure 1.2 presents the interest rate levels in Indonesia over the last ten years:

Source: World Bank (2024)

Figure 1.2 Indonesia's Interest Rate, 2015–2024

Based on Figure 1.2, according to Bank Indonesia (2023), interest rates in 2022 experienced a decline influenced by relatively low inflation conditions and exchange rate stability. This policy was also aimed at maintaining economic growth amid significant external pressures, including the geopolitical tensions arising from the Russia–Ukraine War and the accelerated normalization of monetary policies in both developed

and developing countries. This finding is consistent with previous research conducted by Aulianda (2019), which stated that the interest rate variable has a negative and significant effect on economic growth in Indonesia. Furthermore, during the 2023–2024 period, interest rates continued to decline. According to Bank Indonesia (2024), this decision was consistent with the direction of monetary policy aimed at maintaining inflation within the target range of 2.5 ± 1 percent during 2024 and 2025, while simultaneously supporting sustainable economic growth.

In addition to interest rates, production also serves as an important determinant of economic improvement in Indonesia. Production refers to activities that increase the value of a product. Every country possesses its own primary production sectors that contribute to enhancing economic activities. In the business context, production significantly influences trade activities. In other words, export performance is largely determined by production activities. When production performance is weak, the resulting output is generally only sufficient to meet domestic needs and cannot be exported to international markets (M. Nur, 2022).

The Agriculture, Livestock, Hunting, and Agricultural Services sector plays a highly important role in the national economy. This condition is reflected in the substantial contribution of the agricultural sector to Gross Domestic Product (GDP), which reached approximately 12.53 percent in 2023. This figure positioned the agricultural sector as the second-largest contributor after the Manufacturing sector and the Wholesale and Retail Trade, Car and Motorcycle Repair sector. Such achievements demonstrate that the agricultural sector holds a strategic role within the national economic structure. Moreover, during periods of economic crisis, the agricultural sector has proven to possess relatively stronger resilience compared to other sectors in responding to economic shocks. This resilience makes the agricultural sector one of the primary pillars supporting the recovery process of the national economy.

Sugarcane, as the primary raw material in the sugar industry, is one of the plantation commodities that plays an important role in the economy of Indonesia. With a plantation area reaching approximately 459.51 thousand hectares in 2024, the sugarcane-based sugar industry has become one of the main sources of income for thousands of sugarcane farmers and workers involved throughout the sugar production chain.

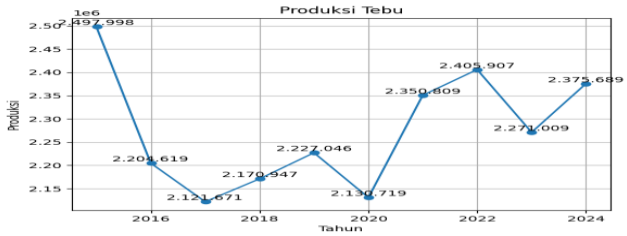
In the future, the government aims to achieve sugar self-sufficiency as part of its strategy to strengthen national food security. Consumer sugar is categorized as a strategic food commodity, as stipulated in Presidential Regulation Number 125 of 2022 concerning the Administration of Government Food Reserves. This policy is intended to maintain food price stability and prevent potential shortages that could disrupt food security and public welfare.

Furthermore, government food reserves function as an intervention instrument to ensure food availability, particularly during emergency situations such as natural disasters and conflicts. In the context of price stabilization, the availability of domestic supply is primarily influenced by the level of domestic production, stock availability, and import policies implemented as balancing measures when national production is insufficient to meet domestic demand.

National demand for consumer sugar has shown an increasing trend from year to year in line with population growth. This rising demand has not yet fully accounted for additional consumption from the continuously expanding industrial sector, thereby reinforcing the urgency of increasing domestic sugar production capacity.

Ministry of Agriculture of the Republic of Indonesia has continuously pursued the achievement of sugar self-sufficiency through various strategies, including land intensification and extensification programs, improvements in the sugarcane purchasing system from farmers, and the strengthening of partnerships between farmers and sugar factories. These efforts are directed toward enhancing productivity and efficiency within the national sugar production chain.

Historically, Indonesia experienced a golden era of the sugar industry during the 1930s, marked by the operation of approximately 179 sugar factories, productivity levels reaching 14.80%, and sugar recovery rates ranging from 11% to 13.80%. During this period, national sugar production was able to reach approximately 3 million tons, with export volumes amounting to around 2.40 million tons. This achievement was supported by several factors, including the availability of fertile land, low-cost labor, irrigation prioritization, and disciplined implementation of technology (Susila et al., 2005a). The following section presents sugarcane production in Indonesia over the past ten years.



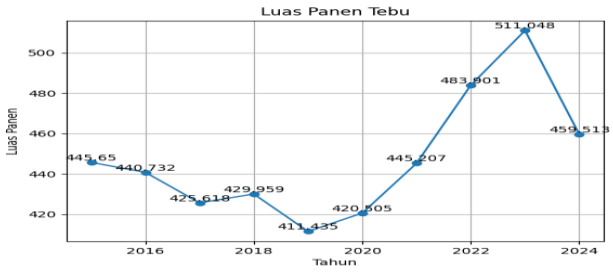
Source: Ministry of Agriculture of the Republic of Indonesia (2024)

Figure 1.3 Sugarcane Production in Indonesia, 2015-2024

Based on Figure 1.3, it can be observed that over the past ten years, a significant decline in sugarcane production occurred in 2016, amounting to 11.76% compared to the previous year. This decline was influenced by the wet dry-season phenomenon associated with La Niña, which adversely affected sugarcane yield recovery rates. As a result, the average growth of sugarcane production during the last decade tended to stagnate, with only a relatively modest increase of approximately 0.4% per year.

According to Sulaksono (2014), production plays a significant role in promoting economic growth. The study demonstrated a strong relationship between production levels and economic growth, indicating that higher production levels positively contribute to economic expansion. This finding highlights the importance of the production sector in strengthening a country's economy.

Although government policies implemented in recent years have been considered more supportive of farmers, several parties argue that such policies remain partial rather than comprehensive and have not yet demonstrated clear intersectoral linkages within the framework of developing an efficient sugar industry (Mardianto et al., 2005). Therefore, the development of a competitive and efficient sugar industry requires the formulation of comprehensive, systematic, and consistent policies with strong coherence among policy instruments. Each policy should be functionally integrated to effectively support the achievement of national development objectives (Mardianto et al., 2005). The development of sugarcane harvested area in Indonesia over the last ten years is presented in Figure 1.4 below.



Source: Ministry of Agriculture of the Republic of Indonesia

Figure 1.4 Sugarcane Harvested Area (Ha) in Indonesia, 2015–2024

Based on Figure 1.4, the expansion of sugarcane cultivation areas in Indonesia faces several constraints, particularly the limited availability of land suitable for sugarcane cultivation and competition for land use with other food commodities, especially rice and secondary crops. The development of sugarcane harvested areas

over the last ten years has shown relatively minor fluctuations. This condition is reflected in the stagnant trend observed during the 2015–2024 period, with an average growth rate of only approximately 0.3% per year.

These conditions indicate that the national expansion of sugarcane cultivation areas has progressed very slowly and, consequently, has not been able to provide a significant contribution to the overall increase in sugarcane production.

This study originates from empirical phenomena and the gap between the potential of the sugarcane agricultural sector and its contribution to national economic growth, as well as Indonesia's dependence on sugar imports despite possessing considerable sugarcane production potential. Although the national sugar industry continues to operate, production levels remain insufficient to satisfy domestic consumption needs. The low level of production achievement may be influenced by several factors, including low sugarcane productivity at the farmer level and the limited revitalization and modernization of sugar factories.

This condition has created a significant gap between domestic production capacity and national market demand. As a result, Indonesia remains dependent on sugar import policies as an instrument to address supply deficits and maintain the stability of domestic sugar availability. For example, according to data from Statistics Indonesia, the government imported approximately 6.01 million tons of sugar in 2022, while in 2023 sugar imports slightly declined to 5.07 million tons (Kompas, 2025). Based on data from the Ministry of Agriculture of the Republic of Indonesia and Statistics Indonesia, Indonesia's sugarcane harvested area exceeds 450 thousand hectares annually; however, domestic sugar production is still unable tc meet national demand.

A review of previous literature indicates that earlier studies primarily focused on the influence of land area and sugarcane productivity on sugar imports rather than on Gross Domestic Product (GDP) or economic growth, the relationship between agricultural production and sectoral Gross Regional Domestic Product (GRDP), as well as the impact of interest rates on investment and economic growth. Nevertheless, there remains a research gap in analyzing the simultaneous interaction between sugarcane harvested area, sugarcane production, and interest rates on economic growth.

Therefore, this topic emerges as an effort to address the existing scientific gap. This research is also highly relevant to the agenda of food security and the development of a self-sufficient national sugar industry, which constitutes part of the National Medium-Term Development Plan (RPJMN) 2020–2024. Sugarcane harvested area and production not only reflect the performance of the plantation subsector but also serve as indicators of labor productivity, farmer welfare, and income distribution within the agricultural sector, all of which contribute to economic growth.

2. Literature Review

Economic Growth

According to Hasyim (2016), economic growth can be defined as an increase in the output of goods and services within a certain period, or as a process of enhancing the production capacity of an economy, which is reflected in the growth of national income.

Meanwhile, according to Sukirno (2012b), economic growth is a measure that describes the development of an economy in a particular year compared to the previous year.

Economic growth can be measured using Gross Regional Domestic Product (GRDP) at constant prices. The formula for calculating economic growth is as follows:

$$G = \frac{PDRB1 - PDRB0}{PDRB0} X\ 100$$ ……(Sukirno, 2012b)

Where :

G = Economic Growth

$PDRB_1$ = PDRB at Constant Prices in the Current Year

$PDRB_0$ = PDRB at Constant Prices in the Previous Year

An economy is considered to experience growth when the quantity of real goods and services produced within a certain period is higher than that of the previous period, while taking into account the existing conditions of available production factors. Therefore, economic growth can be interpreted as a real increase in the production capacity of goods and services over a specific period of time (Roifah, 2022).

Interest Rates

According to Febriyanti (2022), interest rates are defined as the price for the use of investment funds (*loanable funds*). Interest rates serve as one of the key indicators in determining whether individuals choose to invest or save their money. Meanwhile, according to Kasmir (2014), bank interest can be interpreted as compensation provided by banks operating under conventional principles to customers who purchase or utilize banking products and services. Interest may also be understood as the amount paid by banks to customers who hold deposits, as well as the amount that customers are required to pay to banks for borrowed funds.

Sugarcane Production

Production refers to an activity aimed at creating or increasing the utility value of goods and services in order to fulfill human needs. Production is an economic process that transforms factors of production (*inputs*) into production outputs (*outputs*). In other words, it is an activity that processes semi-finished goods into finished goods with the objective of increasing the utility value of such goods or services. The goods and services produced are subsequently traded in both domestic and international markets through export and import activities (Syahidin et al., 2022).

Harvested Area

Harvested area refers to the area of crops that have been successfully harvested and collected after reaching maturity (Ellitan, 1994). Harvested area also refers to the total cultivated land from which crops are harvested and subsequently cleared or uprooted after the harvesting process. In the context of sugarcane cultivation, harvested area can be interpreted as the total plantation area capable of producing sugarcane during each planting period. The unit of measurement used for this variable is hectares.

In the context of sugarcane commodities (*Saccharum officinarum* L.), harvested area holds a highly strategic position because sugarcane is a seasonal plantation crop characterized by a relatively long harvesting cycle and strong linkages with the sugar processing industry. Food and Agriculture Organization (2019) emphasized that for industrial-based commodities such as sugarcane, harvested area not only determines the volume of raw materials produced but also influences supply chain efficiency and the operational capacity of sugar factories.

Conceptual Framework

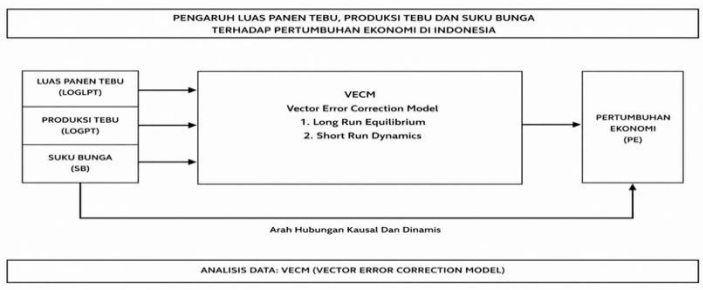


Figure 1.5 Conceptual Framework

Hypotheses

Based on the theoretical foundation and conceptual framework presented above, the hypotheses of this study are formulated as follows:

H_1 : it is hypothesized that sugarcane harvested area has a positive and significant effect on economic growth in Indonesia in both the short run and the long run.

H_2 : It is hypothesized that sugarcane production has a positive and significant effect on economic growth in Indonesia in both the short run and the long run.

H_3 : it is hypothesized that interest rates have a negative and significant effect on economic growth in Indonesia in both the short run and the long run

3. Research Methodology

Types and Sources of Data

This study focuses on harvested area, sugarcane production, and interest rates as independent variables, while economic growth is employed as the dependent variable. The scope of the research covers Indonesia with an observation period spanning from 1990 to 2024.

The data utilized in this study are secondary data, namely data obtained from secondary sources through credible institutions. The information was accessed through official websites to ensure data accuracy in analyzing the relationship between the independent and dependent variables. In this regard, the researcher employed data sourced from the Ministry of Agriculture of the Republic of Indonesia and the World Bank.

Data Collection

This study employed a library research approach as the primary method of data collection. The data were obtained through an extensive review of scientific journals, academic books, and official publications issued by reputable and credible institutions. In addition, documentation techniques were utilized by systematically organizing the collected data into tabulated forms based on the predetermined data sources. The compiled data were subsequently processed and analyzed using the statistical software EViews 10.

Data Analysis Method

The data analysis in this study was conducted using the Vector Error Correction Model (VECM) approach with the assistance of the EViews software program. This method was selected to examine and address the research problems comprehensively. The estimation of the economic model is essential to accurately represent the actual conditions of the observed object of study. The analytical equation employed in this research is presented as follows.

$$\Delta y_t = \alpha e_{t-1} + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + \ldots + \beta_p \Delta y_{t-p+1} + \varepsilon_t$$

The model employed in this study is specified as follows:

$$\Delta PE_t = \alpha e_{t-1} + LOGLPT\Delta y_{t-1} + LOGPT\Delta y_{t-2} + SB\Delta y_{t3} + \varepsilon_t$$

4. Results And Discussion

Stationarity Test

In the Augmented Dickey-Fuller (ADF) test, if the absolute value of the t-statistic is smaller than the MacKinnon critical value at a certain significance level (1%, 5%, and 10%), the data are considered to contain a unit root and are therefore non-stationary. Conversely, if the ADF test statistic exceeds the critical value at the corresponding significance level, the data are regarded as free from a unit root and thus stationary.

In addition, another criterion that can be applied is the probability value (prob) of the t-statistic. A probability value greater than 0.05 indicates the presence of a unit root, implying that the data are non-stationary, whereas a probability value less than 0.05 suggests that

the data are stationary (Mesta, 2014).

Table. 1
Stationarity Test Results

Variabel	Unit Root	ADF T-Statistic	Critical Value	Probability ADF	Keterangan
Pertumbuhan Ekonomi	Level	-4.292269	-2.951125	0.0018	Stasioner
	1st Difference	-5.998460	-2.957110	0.0000	Stasioner
Log Luas Panen Tebu	Level	-1.497311	-2.951125	0.5229	Tidak Stasioner
	1st Difference	-4.153955	-2.954021	0.0027	Stasioner
Log Produksi Tebu	Level	-1.858114	-2.976263	0.3459	Tidak Stasioner
	1st Difference	-3.046436	-2.981038	0.0436	Stasioner
Suku Bunga	Level	-6.090117	-2.981038	0.0000	Stasioner
	1st Difference	-7.040906	-2.981038	0.0000	Stasioner

Source: *Processed Data Results, 2026*

Based on Table 4.1 above, it can be observed that the variables exhibit different levels of stationarity. The economic growth and interest rate variables are stationary at both the level and first difference levels. Meanwhile, sugarcane harvested area and sugarcane production are non-stationary at the level form but become stationary after the first differencing process. Therefore, it can be concluded that this study employs the first difference level of stationarity for further data analysis.

Determination of the Optimal Lag Length

In the estimation process of the Vector Error Correction Model (VECM), the initial step is to determine the optimal lag length. In dynamic analysis, the determination of the optimal lag is important to identify the duration of the response of one variable to changes in another variable. Accordingly, the optimal lag length in this study was determined using the minimum Akaike Information Criterion (AIC), formulated as follows: AIC = -2 (1/T) + 2(k-T) (Erian, 2022).

Table. 2
Optimal Lag Length Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-76.80866	NA	0.001835	5.050541 *	5.233758	5.111273
1	-51.73592	42.31025	0.001051	4.483495	5.399580	4.787151
2	-28.88826	32.84352 *	0.000722 *	4.055516 *	5.704469 *	4.602097 *

Source : Processed Data Results, 2026

Berdas Based on the table above, it can be observed that all four criteria indicate the smallest value at lag 2. This is reflected in the Akaike Information Criterion (AIC) value of 4.05, which is marked by an asterisk (*) for the respective lag criterion. Therefore, this study adopts lag 2 as the optimal lag length to define the period of influence of the independent variables on the dependent variable.

Granger Causality

The causality test is conducted to determine whether there is a causal relationship among endogenous (dependent) variables, thereby allowing certain variables to be treated as exogenous (independent) variables. In this study, the causality analysis was performed using the Granger causality method. The predictive power derived from the available information, both theoretical and empirical, indicates the existence of causal relationships among variables over a certain period of time. Accordingly, the Granger causality test was employed to analyze the causal relationships among the variables under investigation.

Table. 3
Granger Causality

Null Hypothesis:	Obs	F-Statistic	Prob.
LOGLPT does not Granger Cause PE	33	9.47526	0.0007
PE does not Granger Cause LOGLPT		1.24321	0.3039
SB does not Granger Cause PE	33	0.16515	0.8486
PE does not Granger Cause SB		5.92530	0.0071

LOGPT does not Granger Cause PE	33	0.74006	0.4862
PE does not Granger Cause LOGPT		0.44835	0.6432
SB does not Granger Cause LOGLPT	33	2.80078	0.0778
LOGLPT does not Granger Cause SB		0.47662	0.6258
LOGPT does not Granger Cause LOGLPT	33	4.77686	0.0164
LOGLPT does not Granger Cause LOGPT		5.53259	0.0094
LOGPT does not Granger Cause SB	33	2.78197	0.0791
SB does not Granger Cause LOGPT		1.70628	0.1999

Source: Processed Data Results, 2026

Based on Table 4.3 above, it can be observed that there is a causal relationship between sugarcane harvested area and economic growth, as indicated by a probability value of 0.00 < 0.05. However, economic growth does not exhibit a causal relationship with sugarcane harvested area, as reflected by a probability value of 0.30 > 0.05.

Furthermore, the interest rate variable does not have a causal relationship with economic growth, indicated by a probability value of 0.84 > 0.05. In contrast, economic growth demonstrates a causal relationship with interest rates, with a probability value of 0.00 < 0.05.

The sugarcane production variable does not exhibit a causal relationship with economic growth, as indicated by a probability value of 0.48 > 0.05. Similarly, economic growth does not have a causal relationship with sugarcane production, with a probability value of 0.64 > 0.05.

In addition, interest rates do not have a causal relationship with sugarcane harvested area, as reflected by a probability value of 0.07 > 0.05. Likewise, sugarcane harvested area does not exhibit a causal relationship with interest rates, indicated by a probability value of 0.62 > 0.05.

Meanwhile, sugarcane production demonstrates a causal relationship with sugarcane harvested area, as shown by a probability value of 0.01 < 0.05. Similarly, sugarcane harvested area also has a causal relationship with sugarcane production, indicated by a probability value of 0.00 < 0.05.

Lastly, sugarcane production does not exhibit a causal relationship with interest rates, as indicated by a probability value of 0.07 > 0.05. Likewise, interest rates do not have a causal relationship with sugarcane production, with a probability value of 0.19 > 0.05.

Cointegration Test

To identify the existence of cointegration, several approaches may be employed, including the Engle-Granger (EG), Augmented Engle-Granger (AEG), and Durbin-Watson Cointegration Regression (CRDW) tests. The presence of cointegration among two or more time series variables indicates the existence of a long-run equilibrium relationship, implying that the variables maintain a stable long-term association.

Cointegration is confirmed when the trace statistic value exceeds the critical value and the probability value (alpha) is below 0.05. Conversely, if the trace statistic is smaller than the critical value and the probability value exceeds 0.05, the variables are considered not cointegrated.

Table.4
Cointegration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.** Critical Value
None *	0.660221	74.59434	47.85613	0.0000
At most 1 *	0.434807	41.13105	29.79707	0.0017
At most 2 *	0.375582	23.44284	15.49471	0.0026
At most 3 *	0.248200	8.843833	3.841465	0.0029

Source: Processed Data Results, 2026

Based on the table above, it can be observed that all trace statistic values are greater than their respective critical values. At the none level, the trace statistic value is greater than the 5% critical value, namely 74.59 > 47.85. At the at most 1 level, the trace statistic value is also greater than the 5% critical value, namely 41.13 > 29.79. Furthermore, at the at most 2 level, the trace statistic value exceeds the 5% critical value, specifically

23.44 > 15.49. Similarly, at the at most 3 level, the trace statistic value is greater than the 5% critical value, namely 8.843 > 3.841.

Based on the results of the cointegration test, it can be concluded that the variables employed in this study possess a stable long-run equilibrium relationship, while also experiencing temporary short-run fluctuations among all variables. In addition, the variables tend to adjust toward achieving equilibrium in the long term. Therefore, further analysis in this study can appropriately be conducted using the Vector Error Correction Model (VECM).

Vector Autoregression (VAR) Stability Test

The VAR stability test must be conducted prior to proceeding to the subsequent stages of analysis. This is because if the estimated VAR model combined with the error correction model does not satisfy the stability condition, the results of the Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) analyses become invalid.

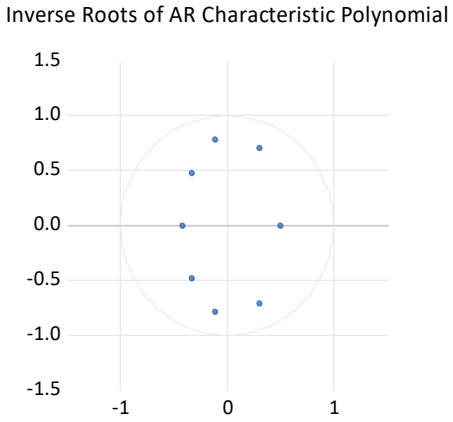
The stability test is performed through the VAR stability condition check by examining the roots of the characteristic polynomial derived from the estimated model. A VAR system is considered stable if all root values possess a modulus of less than one (Lisa, 2014)

Table. 5
Vector Autoregression (VAR) Stability Test

Root	Modulus
-0.115773 - 0.781516i	0.790045
-0.115773 + 0.781516i	0.790045
0.305340 - 0.705204i	0.768469
0.305340 + 0.705204i	0.768469
-0.330370 - 0.480731i	0.583307
-0.330370 + 0.480731i	0.583307
0.495946	0.495946
-0.424251	0.424251

Source: Processed Data Results, 2026

Based on Table 4.5 above, it can be observed that none of the root characteristic and modulus values exceed 1. This indicates that the VECM model is stable and valid, thereby allowing further analysis using the Impulse Response Function (IRF) and Variance Decomposition (VD) methods to be conducted. In addition to the table above, the VAR stability test can also be illustrated through the following figure:



Source: Processed Data Results, 2026

Figure 1.6 ***Inverse Roots of AR Characteristic Polynomial***

From the figure above, it can be observed that no points lie outside the circle, indicating that the Vector Autoregression (VAR) model satisfies the stability condition. Based on these results, the VAR stability test demonstrates that the VAR equation possesses modulus values of less than 1 at lag 1. Therefore, it can be concluded that the VAR model established in this study is stable at the optimal lag length, namely lag 1.

Estimation Results of the Vector Error Correction Model (VECM)

The estimation of the Vector Error Correction Model (VECM) was conducted to identify both the long-run and short-run cointegration relationships among the variables. The short-run VECM estimation results in this study are presented as follows:

Table. 4
Short-Run VECM Estimation Results

Variable	Coefficient	T-statistic	t-Table (α: 5%)
CointEq1	-1.730331	-2.79011	1,695519
D(PE(-1),2)	0.319218	0.68222	
D(LOGLPT(-1),2)	66.83657	4.86246	
D(LOGPT(-1),2)	-39.58089	-4.41692	
D(SB(-2),2)	0.160035	0.58742	

Source: Processed Data Results, 2026

Based on the table above, the VECM estimation results can be formulated into the following equation model:

$$\Delta PE_t = \text{-1,73 ECT}_{t\text{-}1} + 0{,}31\ \Delta DPE_{(-1),2)} + 66{,}83\ \Delta DLOGLPT_{(-1),2)} - 39{,}58 \Delta DLOGPT_{(-1),2)} + 0{,}16\ \Delta DSB_{(-2),2)}$$

The error correction term coefficient of 1.73, which is significant at the 5% significance level, indicates the existence of an adjustment mechanism toward long-run equilibrium. An absolute coefficient value greater than one reflects a rapid adjustment process (overshooting), yet it remains within the range of dynamic stability as long as all characteristic roots lie within the unit circle. The CointEq1/ECT value of 1.73 implies that disequilibrium is corrected by approximately 173% within one period. Consequently, the estimated time required to restore equilibrium is approximately 0.57 periods (months), equivalent to about 6.93 months.

The sugarcane harvested area variable at lag 1 has a t-statistic greater than the t-table value, namely 4.86 > 1.69. This result indicates a positive and statistically significant effect on economic growth in Indonesia at the 5% significance level. The coefficient of D(LOGLPT(-1),2) amounting to 66.83 suggests that a 1% increase in sugarcane harvested area in the previous period is capable of increasing economic growth by approximately 0.668 points in the short run, assuming other variables remain constant.

Meanwhile, the sugarcane production variable at lag 1 exhibits a negative and significant effect on economic growth in Indonesia at the 5% significance level. The coefficient of D(LOGPT(-1),2) amounting to −39.58 indicates that a 1% increase in sugarcane production in the previous period tends to reduce economic growth by approximately 0.3958 points in the short run, ceteris paribus.

Furthermore, the interest rate variable at lag 2 has a coefficient value of 0.160035 with a t-statistic value of 0.58742, which is smaller than the t-table value of 1.695 at the 5% significance level. This finding indicates that although the interest rate coefficient is positive, changes in interest rates from two previous periods do not exert a statistically significant effect on changes in the dependent variable in the short run. Therefore, the direction of the relationship indicated by the coefficient cannot be interpreted economically, implying that the short-run effect of interest rates is relatively weak and cannot yet be empirically validated. These findings suggest that the role of interest rates is more likely to be reflected in long-run relationships rather than in short-run dynamics. The long-run estimation results of the VECM model are presented as follows:

Table. 5
Long-Run VECM Estimation Results

Variable	Coefficient	t-Statistic	t-Table (α: 5%)
C	0.250452	-	1,695519
D(LOGLPT(-1))	19.59545	2.65584	
D(LOGPT(-1))	-16.33490	-2.91083	
D(SB(-1))	0.741897	4.78833	

Source: Processed Data Results, 2026

Based on Table 4.7 above, the interpretations of the long-run VECM estimation results are presented as follows.

$$\Delta PE_t = 0{,}250452 + 19{,}59\ \Delta DLOGLPT_{(-1)} - 16{,}33 \Delta DLOGPT_{(-1)} + 0{,}74 \Delta DSB_{(-1)}$$

Based on Table 4.7 above, the interpretations of the long-run VECM estimation results are presented as follows.

The constant value is 0.2504, indicating that when sugarcane harvested area, sugarcane production, and interest rates remain constant, economic growth in

Indonesia will remain constant at approximately 0.25% in the long run.

The sugarcane harvested area variable has a positive and significant effect on economic growth in the long run. This can be observed from the t-statistic value, which is greater than the t-table value, namely 2.65 > 1.69. This implies that every 1% increase in sugarcane harvested area will increase economic growth by approximately 0.1959 points, assuming that sugarcane production and interest rates remain constant.

Meanwhile, the sugarcane production variable exerts a negative and significant effect on economic growth in the long run. This is indicated by the t-statistic value exceeding the t-table value in absolute terms, namely $-2.91 < -1.69$ or $|2.91| > 1.69$. This finding suggests that every 1% increase in sugarcane production will reduce economic growth by approximately 0.16334 points.

Furthermore, the interest rate variable has a positive and significant effect on economic growth in the long run. This is reflected by the t-statistic value being greater than the t-table value, namely 4.78 > 1.69. This result implies that every 1% increase in interest rates will increase economic growth by approximately 0.74%.

5. Conclusion

Based on the results of this study, the following conclusions can be drawn:

1. In both the short run and the long run, sugarcane harvested area has a positive and significant effect on economic growth in Indonesia. This finding is consistent with the theory proposed by Gujarati and Porter (2010), which states that an increase in sugarcane harvested area contributes to higher economic growth.
2. In both the short run and the long run, sugarcane production has a negative and significant effect on economic growth in Indonesia. This finding is inconsistent with the theories proposed by Sukirno (2012) and Sulaksono (2014), which suggest that increased production should lead to higher economic growth.
3. In the short run, interest rates have a positive but insignificant effect on economic growth in Indonesia. However, in the long run, interest rates exert a positive and significant effect on economic growth. This finding is in line with the theory proposed by Sunariyah (2013), which states that an increase in interest rates may contribute to economic growth.

4. Suggestions

The recommendations proposed in this study are as follows:

1. it is recommended that Bank Indonesia and other relevant institutions continue to maintain interest rate stability by considering various factors originating from both domestic and external economic conditions. Stable interest rates are expected to create a sense of security and public confidence in conducting economic activities. Moreover, interest rate stability may contribute to achieving more sustainable and stable economic growth.
2. Policymakers, including both government institutions and private sector stakeholders, are encouraged to continuously improve the quality and productivity of sugarcane production in order to enhance sugar supply in international markets. In addition, greater attention should be given to maintaining sugar price stability to ensure that sugarcane farmers obtain adequate income and a decent standard of living, thereby improving their overall welfare as the primary actors in the sugarcane agricultural sector
3. The government is also advised to continuously optimize the production sector, considering its

crucial role in promoting economic growth in Indonesia. Increased production output is expected to enhance national export value, thereby supporting the achievement of more stable, sustainable, and advanced economic growth.

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