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ANALYSIS OF THE INFLUENCE OF INFLATION, EXCHANGE RATE, AND POPULATION ON INDONESIA'S ECONOMIC GROWTH 1993–2023: VECM APPROACH

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Abstract

This study aims to analyze the influence of inflation, exchange rate, and population on Indonesia's economic growth from 1993 to 2023 using the Vector Error Correction Model (VECM) approach. The research utilizes secondary data obtained from the Central Statistics Agency (BPS) and the World Bank. The stationarity test shows that most variables become stationary at the first difference. Johansen cointegration test results indicate a long-term equilibrium relationship among the variables. In the short run, VECM estimation results show that only the population variable is significantly affected by changes in other variables, while inflation and exchange rate do not show significant short-term impacts. The Impulse Response Function (IRF) and Variance Decomposition analysis confirm that population has a more dominant and persistent effect on economic growth compared to inflation and exchange rate, both of which exhibit relatively weak influence. These findings highlight the strategic role of demographic dynamics in shaping macroeconomic performance. Therefore, improving population quality and managing demographic trends should be prioritized in national development planning to support inclusive and sustainable economic growth in Indonesia.

Keywords: Inflation, Exchange Rate, Population, Economic Growth.

INTRODUCTION

Economic growth is one of the important indicators that reflects the performance and stability of a country's economy. Todaro & Smith (2003) explain that economic growth is an increase in the long-term capacity of the country concerned to secure various assets. Based on this opinion, the conclusion can be drawn that there is a relationship between the country's population and economic growth. Economic growth in Indonesia plays a role as a foundation in efforts to achieve sustainable development, poverty alleviation, and improving the welfare of society as a whole. During the period 1993 to 2023, Indonesia's economic growth faced complex dynamics, both domestically and globally, such as the 2008 global financial crisis, the weakening of the rupiah exchange rate, and the economic impact of the COVID-19 pandemic.

One important aspect in understanding fluctuations in economic growth is to look at the influence of key macroeconomic variables such as inflation, exchange rates, and population. Inflation, as an indicator of price stability, can influence consumption and investment decisions, which ultimately have an impact on national output (Mankiw, 2016). The exchange rate reflects the international competitive position and affects the trade balance and foreign capital flows (Krugman & Obstfeld, 2009). Meanwhile, population plays an important role in providing labor and creating domestic demand, but it can also be a challenge if it is not balanced with the productivity and quality of human resources (Todaro & Smith, 2020).

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Various empirical studies have shown that the relationship between the three variables and economic growth is not linear and can differ between countries and periods. Therefore, an econometric approach is needed that is able to capture the dynamic relationship between variables, both in the short and long term. One appropriate approach is the Vector Error Correction Model (VECM), which is able to identify the long-run equilibrium relationship as well as the short-run dynamics between variables that influence each other (Gujarati & Porter, 2009).

Based on this background, this study aims to analyze the effect of inflation, exchange rates, and population on Indonesia's economic growth in the short and long term during the period 1993–2023 using the VECM approach. The results of this study are expected to provide theoretical contributions to macroeconomic literature and become a consideration for policy makers in formulating inclusive and sustainable economic development strategies.

LITERATURE REVIEW

Studies on the relationship between macroeconomic variables such as inflation, exchange rates, and population to economic growth have been conducted by many previous researchers using various approaches and yielding diverse results. These studies form an important foundation for understanding the dynamics of the Indonesian economy more comprehensively, as they highlight how these variables interact and influence long-term economic performance. By examining the findings of prior research, policymakers and economists can gain valuable insights into the effectiveness of economic policies, identify patterns of economic fluctuation, and formulate strategies to promote sustainable growth. Moreover, understanding these relationships is crucial in the context of Indonesia’s rapidly evolving economic landscape, where external shocks, demographic shifts, and monetary instability may significantly impact macroeconomic stability and development outcomes.

Inflation

Inflation is a condition in which there is a general and continuous increase in the price of goods and services in a certain period. According to Mankiw (2016), inflation is caused by the growth of the money supply that is faster than the growth of real output. In the long term, inflation can erode people's purchasing power and create economic uncertainty that has a negative impact on investment and consumption decisions. The Quantity Theory of Money introduced by Irving Fisher states that inflation occurs when the amount of money circulating in the economy increases excessively (MV = PT), where M is the amount of money in circulation, V is the velocity of money circulation, P is the price level, and T is the volume of transactions.

Exchange Rate

The exchange rate is the price of a country's currency expressed in the currency of another country. One of the classical theories underlying exchange rate movements is Purchasing Power Parity (PPP) which states that the exchange rate will adjust to balance purchasing power between two countries. In this theory, if a country experiences higher

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inflation than another country, its exchange rate will depreciate. Krugman and Obstfeld (2009) state that the exchange rate is greatly influenced by factors such as relative inflation, interest rates, and the current account balance. Exchange rate fluctuations can affect the competitiveness of exports and imports and have an impact on macroeconomic stability.

Population

The population in a development economy plays a role as both an input (labor) and a market (consumers) in the economic system. Todaro and Smith (2020) highlight that population has a dual impact on the economy. On the one hand, population growth creates a large domestic market and provides labor, but on the other hand it can put pressure on infrastructure, natural resources, and public services if it is not accompanied by increased productivity. The Demographic Transition Theory also explains how the population structure changes along with the economic development of a country, which then has an impact on the dynamics of economic growth.

Economic Growth

Kalalo (2016) identified that factors such as money supply, interest rates, and exchange rates contribute greatly to the inflation rate in Indonesia. The implication of this study is that macroeconomic stability, including inflation control, is the main foundation in creating an economic climate conducive to economic growth. Economic growth is defined as an increase in the capacity of producing goods and services in an economy over time.

One of the classic theories of growth is the Solow Growth Model, which emphasizes the importance of capital accumulation, population growth, and technological progress in influencing long-term output. In the Solow model, output (Y) is influenced by capital (K), labor (L), and technology (A) which are formulated in the production function $Y = A\,F\,(K, L)$. In addition, the endogenous growth theory developed by Romer emphasizes the role of investment in education, innovation, and research as the main drivers of growth.

Previous Studies

Astuti and Prasetyanto (2022) analyzed the effects of inflation, exchange rates, and population on economic growth in Indonesia using the Vector Error Correction Model (VECM) approach. They found that in the long run, the three variables have a cointegration relationship with economic growth, although in the short run the effect tends to be insignificant. This finding shows the importance of a long-term approach in formulating macroeconomic policies. Muzakki (2024) examined the impact of inflation and exchange rates on the profitability of Islamic banks in Indonesia and found that macroeconomic fluctuations significantly affect the performance of the financial sector. Although focused on the banking sector, this study emphasizes the importance of inflation and exchange rate stability in supporting economic growth in general.

Methodologically, the use of the VECM approach in this study is in accordance with the recommendations of Gujarati and Porter (2009) who stated that this model is able to

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capture the long-term relationship between non-stationary cointegrated variables. Thus, this approach can more accurately describe the dynamics of the relationship between inflation, exchange rates, population, and economic growth in Indonesia in the short and long term. Based on the literature review, it is apparent that there is a gap between previous empirical results, especially in terms of the strength and direction of the influence between variables, which emphasizes the importance of updating research with the latest data and appropriate approaches such as VECM.

In addition, a study by Ochieng et al. (2023) in Kenya found a long-run relationship and two-way causality between population growth and economic growth. The study used a time series approach and showed that population has a positive effect on economic growth in the long run. These results reinforce the importance of considering demographic variables in economic growth models, especially in developing countries. Thus, this study provides a relevant empirical contribution, especially by using the VECM approach that combines short-term and long-term dynamics and highlights the strategic role of population size on national economic growth more comprehensively.

METHOD

Stationarity Test

The first step taken in the VECM model is to test the stationarity of all variables in the study using the unit root test. The purpose of the stationary test is to avoid spurious regression, which is a regression that describes the relationship between two statistically significant variables when in reality it is not (El Ayyubi et al., 2017). The stationarity test in this study uses Augmented Dickey-Fuller (ADF). The following is the basic form of the stationarity test (Gujarati & Porter, 2009).

Dickey Fuller (DF)

$$\Delta Yt = \delta Yt\text{-}1 + \varepsilon t$$

$$\Delta Yt = \beta 1 + \delta Yt\text{-}1 + \varepsilon t \; \Delta Yt = \beta 1 + \beta 2t + \delta Yt\text{-}1 + \varepsilon t$$

Augmented Dickey Fuller (ADF)

$$\Delta Yt = \delta Yt\text{-}1 + \sum_{i=1}^{k} \alpha i \Delta Yt\text{-}i + \varepsilon t$$

$$\Delta Yt = \beta 1 + \delta Yt\text{-}1 + \sum_{i=1}^{k} \alpha i \Delta Yt\text{-}i + \varepsilon t$$

$$\Delta Yt = \beta 1 + \beta 2t + \delta Yt\text{-}1 + \sum_{i=1}^{k} \alpha i \Delta Yt\text{-}i + \varepsilon t$$

The best model in the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests is determined based on the lowest Akaike Information Criterion (AIC) value. The invalidity of the DF and ADF tests is usually caused by the nature of time series data that shows an

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explosive pattern (Gujarati & Porter, 2009). In this test, the null hypothesis (H0) states that the parameter δ is equal to zero (H0: $\delta = 0$), which means the data is not stationary, while the alternative hypothesis (HA) states that δ is less than zero (H1: $\delta < 0$), which indicates the data is stationary. If the probability value of the t-statistic exceeds the specified significance level, then the decision taken is to accept the null hypothesis.

Optimal Lag Determination

In the context of regression with time series data, the dependent variable (Y) is not always directly influenced by the independent variables (X) (Gujarati & Porter, 2009). The interaction between Y and X can be delayed, where the influence of X is only felt by Y after several periods. This delay phenomenon or lag can arise due to various factors such as individual perception (psychological), technology adaptation processes, or institutional regulations. In order for the model built to be able to represent the dynamics of the relationship between variables optimally, determining the appropriate lag length is crucial in time series analysis. To choose the most appropriate lag, a number of indicators are usually used such as the Akaike Information Criterion (AIC), Schwarz Criterion (SC), Final Prediction Error (FPE), Likelihood Ratio (LR), and Hannan-Quinn Criterion (HQ) (Greene, 2003).

Johansen Cointegration Test

Cointegration is a phenomenon that can only occur between non-stationary variables. In statistical analysis, cointegration is achieved when a combination of several variables, each of which is non-stationary, produces a stationary combination, so that the instability of each variable cancels out each other. From an economic perspective, two or more variables are said to have a cointegrative relationship if they move together in the long run and reflect a long-run equilibrium. If the residuals ($\mathcal{E}t$) of the equation connecting the variables Yt and Xt are proven to be stationary, then the two variables are considered cointegrated. To detect this relationship, two main approaches are used: the Engle-Granger two-stage method and the Johansen approach. The Johansen approach is designed to test for the existence of a cointegration relationship in a system involving more than two variables simultaneously (in vector form). The basic model of the Johansen approach is explained as follows:

$$Yt = A1Yt\text{-}1 + \cdots + ApYt\text{-}p + BXt + et$$

Vector Error Correction Model (VECM)

The Error Correction Model (ECM) is applied in the non-structural VAR framework when the time series data is not stationary at the level level, but becomes stationary after differentiation, and there are indications of a cointegration relationship between the variables (Widarjono, 2018). The presence of cointegration in this model makes the Vector Error Correction Model (VECM) a form of VAR that is subject to restrictions or restricted VAR. VECM is known as a powerful approach because it is able to combine short-term dynamics and long-term relationships in a balanced manner. The specification of this model allows for

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restrictions on long-term interactions between variables to remain in the equilibrium trajectory, while accommodating short-term fluctuations flexibly. The term "error correction" refers to an adjustment mechanism when there is a deviation from long-term equilibrium, where the system gradually makes corrections through a dynamic process in the short term.

In general, the VECM model can be written as follows:

$$\Delta Yt\text{-}1 = \mu t + \prod Yt\text{-}1 + \sum k\ i\text{=-}11\ 1 \prod i\ \Delta Yt\text{-}1 + et$$

The VECM model used in this study is:

Model 1

$$GDPGt = C1 + a1i \sum GDPGt\text{-}k + a1i \sum OERt\text{-}k + a1i \sum POPt\text{-}k + a1i \sum CPIt\text{-}k + ei$$

Model 2

$$OERt = C2 + a1i \sum OERt\text{-}k + a1i \sum GDPGt\text{-}k + a1i \sum POPt\text{-}k + a1i \sum CPIt\text{-}k + ei$$

Model 3

$$POPt = C3 + a1i \sum POPt\text{-}k + a1i \sum GDPGt\text{-}k + a1i \sum OERt\text{-}k + a1i \sum CPIt\text{-}k + ei$$

Model 4

$$CPIt = C4 + a1i \sum CPIt\text{-}k + a1i \sum GDPGt\text{-}k + a1i \sum OERt\text{-}k + a1i \sum POPt\text{-}k + ei$$

Description:

GDPG = Economic Growth OER = Exchange Rate (Exchange Rate)

POP = Population

CPI = Inflation Hypothesis test $H0$: $\sum m\ j\text{=}1\ \delta i = 0$; with HA: $\sum m\ j\text{=}1\ \delta i \neq 0$. The test method is if

$t - statistic > t - table$ then accept the null hypothesis.

The analysis tools used in the VAR/VECM system are Impulse Response Function (IRF) and Variance Decomposition (VD).

Impulse Response Function (IRF)

After the VAR model estimation using the VECM approach is carried out, the next step is to analyze how the variables in the system respond to shocks from other variables. Because the coefficients in the VAR or VECM model are difficult to interpret directly, the Impulse Response Function (IRF) analysis is used. This concept was first introduced by Sims (1980) and is now an important tool in VAR/VECM analysis. IRF is used to see how endogenous variables react to changes or shocks to the error component (et) in the system.

Variance Decomposition (VD)

In addition to IRF, the VAR model also provides another analysis tool, namely Variance Decomposition (VD), or forecast error variance decomposition. Unlike IRF which traces the impact of shocks from one variable on another variable, VD measures how much each variable contributes to explaining the variation (variance) of prediction errors from a particular variable. VD is also useful for assessing the importance of the role of each variable in the system and predicting the proportion of the influence of shocks on other variables over a certain period of time.

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RESULTS AND DISCUSSION

Stationarity Test

Table 1. Stationarity Test Results
Intermediate ADF Test Results

Variable	Prob.	Conclusion
CPI	0.2120	Not stationary at level
GDPG	0.0019	Stationary at level
OER	0.5101	Not stationary at level
POP	0.3933	Not stationary in level

Source: Data processed by Eviews (2025)

Based on the results of the panel data stationarity test using the ADF - Fisher and Choi Z-stat methods, only the GDPG variable (GDP growth) is stated to be stationary at the level, with a p-value of 0.0019 which is smaller than 0.05. This means that the GDPG data does not contain a unit root and fluctuates stably around the average, so it can be used directly in further analysis. Meanwhile, the CPI (Consumer Price Index), OER (Official Exchange Rate), and POP (Population) variables have p-values greater than 0.05, namely 0.2120, 0.5101, and 0.3933, respectively. This shows that the three variables are not yet stationary at the level, so they still contain unstable trends or fluctuations. Therefore, a stationarity test is needed on the first difference (Δ) to see if the variables become stationary after being lowered once.

Stationarity Test at First Difference Level

Table 2. Stationarity Test Results
At the First Difference Level

Variable	Prob.	Conclusion
D(CPI)	0.0003	Stationary in first difference
D(GDPG)	0.0001	Stationary in first difference
D(OER)	0.0702	Not yet stationary
D(POP)	0.7702	Not yet stationary

Source: Data processed by Eviews (2025)

Based on Table 2 above, the results of the panel data stationarity test at the first difference level show that overall, the variables in the study become stationary after one differentiation. This is indicated by the probability value of the ADF - Fisher Chi-square method of 0.0000 and the ADF - Choi Z-stat of 0.0000, both of which are below the 5% significance level. Thus, the null hypothesis stating the presence of a unit root can be

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rejected, which means that the data has been stationary on a panel basis. Individually, the CPI (Consumer Price Index) and GDPG (GDP Growth) variables show significant results with p-values of 0.0003 and 0.0001, respectively, indicating that both have become stationary after the first difference. However, the OER (Official Exchange Rate) and POP (Population) variables still show quite high probability values, of 0.0702 and 0.7702, respectively, so they cannot be said to be stationary.

VAR Estimation

Table 3. VAR Estimation Results

Statistics	D(CPI)	D(GDPG)	D(OER)	D(POP)
R-squared	0.7946	0.6139	0.5539	0.9465
Adj. R-squared	0.5796	0.1633	-0.0059	0.8695
S.E. of regression	51.324	1.381.540	57.174	2.854.531
F-statistic	37.100	13.284	0.9036	120.608
Log likelihood	-712.062	-174.417	-712.674	-202.093
Akaike AIC	80.165	173.767	81.014	204.075
Schwarz SC	90.893	184.494	91.742	214.803

Source: Data processed by Eviews (2025)

Based on the VAR estimation results, the best model in explaining the variation is D(POP) with an R-squared of 0.9465, followed by D(CPI) of 0.7946. In contrast, the model for D(OER) has the lowest R-squared, indicating the weakest explanatory ability. Several variables show significant effects, such as D(OER(-1)) and D(OER(-2)) on D(GDPG), and D(POP(-1)) and D(POP(-2)) on D(GDPG). Meanwhile, D(GDPG(-1)), D(GDPG(-2)), D(CPI(-1)), and D(CPI(-2)) are not significant to other variables. Overall, the D(POP) model has the highest F-statistic (12.06), indicating strong significance. The D(CPI) model is also quite significant (F = 3.71), while D(GDPG) and D(OER) have F-statistics below 2, indicating weakness in explaining the related variables.

LAG VECM

Table 4. LAG VECM Results

Lag	AIC	SC	HQ
0	73.76	73.96	73.81
1	71.69	72.67	71.95
2	70.35	72.11	70.81
3	70.66	73.22	71.34

Source: Data processed by Eviews (2025)

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Based on the VECM lag table, it can be seen that each information criterion gives different results, but the majority points to lag 2 as the best choice. Akaike Information Criterion (AIC) and Hannan-Quinn (HQ) show the lowest values at lag 2, at 70.3452 and 70.81406, respectively, indicating an optimal balance between model complexity and data fit. The Final Prediction Error (FPE) is also the smallest at lag 2, which is 4.87e+25, indicating a high level of predictive accuracy. In addition, the Likelihood Ratio Test (LR) provides a statistical value of 40.21063* at lag 2, which is statistically significant, thus supporting the addition of lag from 1 to 2. The only criterion that chooses lag 1 is the Schwarz Criterion (SC) with the lowest value of 72.67434, but SC is known to be conservative because it gives a greater penalty to complex models. Thus, lag 2 is the most appropriate choice to use in estimating the VECM model.

Stability Analysis in VECM

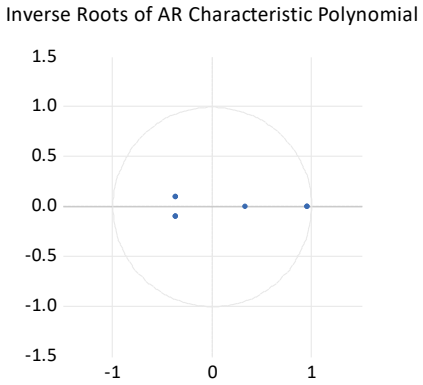

Figure 1. Stability Analysis Modulus Diagram
Source: Data processed by Eviews (2025)

Based on the inverse roots of AR characteristic polynomial diagram, it can be seen that all inverse root points are inside the unit circle. This shows that the VECM model used is dynamically stable. This stability is important because it shows that the response of variables in the model to a shock will subside over time and does not cause the model to become divergent or uncontrolled. Thus, the VECM model built can be relied on for long-term analysis and has validity in predicting or simulating the relationship between variables.

Table 5. Stability Analysis Modulus Table

Root	Modulus
0.955469	0.955469
-0.368726 - 0.101974i	0.382567
-0.368726 + 0.101974i	0.382567
0.334081	0.334081

Source: Data processed by Eviews (2025)

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Based on the modulus table of the characteristic polynomial roots in the VAR model, it can be concluded that the model meets the stability conditions. The table shows four roots with modulus values of 0.955469, 0.382567 (two conjugate complex roots), and 0.334081, respectively. All of these modulus values are below one, meaning that no roots are located outside the unit circle.

The stability of the VAR model is determined by the location of the characteristic roots in the unit circle on the complex plane. If all roots have a modulus of less than one, then the model is said to be stable. Based on the results in the table, the VAR model with endogenous variables D(CPI), D(GDPG), D(OER), and D(POP), as well as exogenous variables in the form of constants (C), has met this requirement. With a lag specification (1,1), it means that the model only uses one lag in the estimation process. Therefore, based on the table, it can be concluded that the VAR model used is stable and suitable for further analysis.

Cointegration Test in VECM

Table 6. Cointegration Test Results

Hypothesis Number of CE	Trace Statistic	Critical Value 5%	p-value	Conclusion
None (r = 0)	1.335.773	4.785.613	0.0000	Reject H_0
At most 1 (r ≤ 1)	5.679.736	2.979.707	0.0000	Reject H_0
At most 2 (r ≤ 2)	1.572.178	1.549.471	0.0462	Reject H_0
At most 3 (r ≤ 3)	1.746.287	3.841.465	0.1863	Fail to reject H_0

Source: Data processed by Eviews (2025)

Based on the results of the Unrestricted Cointegration Rank Test (Trace) in table 5, it can be concluded that there are three cointegrating equations between the variables in the model at a significance level of 5%. This test is used in the context of the VECM (Vector Error Correction Model) model to determine whether there is a long-term relationship between the non-stationary variables used.

Engle Granger Causality Analysis

Table 7. Granger Causality Test Results

Causal Relationship	Direction of Causality	P-Value	Description
GDPG → CPI	Not significant	0.8202	No causality
CPI → GDPG	Not significant	0.8138	No causality
OER → CPI	Significant	0.0242	Causality exists
CPI → OER	Significant	0.0286	Causality exists
POP → CPI	Significant	0.0343	Causality exists

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CPI → POP	Not significant	0.9194	No causality
OER → GDPG	Weak indication	0.0601	Weak indication of causality
GDPG → OER	Weak indication	0.0985	Weak indication of causality
POP → GDPG	Not significant	0.1647	No causality
GDPG → POP	Not significant	0.1086	No causality
POP → OER	Significant	0.0263	Causality exists
OER → POP	Nearly significant	0.0535	Possible weak two-way causality

Source: Data processed by Eviews (2025)

Based on the results of the Granger causality test presented in the table, it can be concluded that there are several short-term causal relationships between the variables in the model. This test examines whether a variable can help predict another variable using its past information, and significance is determined based on the probability value (p-value) below 0.05.

The test results show that there is no causal relationship between GDPG (GDP growth) and CPI (inflation) because both directions of the relationship show high p-values, namely 0.8202 and 0.8138. On the other hand, between OER (exchange rate) and CPI there is a significant two-way causal relationship, indicated by a p-value of 0.0242 for the OER → CPI direction and 0.0286 for the CPI → OER direction. This indicates that the exchange rate and inflation influence each other in the short term.

In addition, a one-way causal relationship was found from POP (population) to CPI, with a p-value of 0.0343, while the reverse direction was not significant. This shows that population change affects inflation, but inflation does not affect population in the short run. The relationship between OER and GDPG is not significant, although the values are close to the 5% threshold (p-values of 0.0601 and 0.0985), which can be considered a weak indication of a potential relationship that needs to be explored further. Similarly, there is no significant causal relationship between POP and GDPG. Finally, there is a one-way causal relationship from POP to OER with a p-value of 0.0263, while the reverse direction is close to significance (p-value 0.0535), which can be considered an early indication of a possible two-way relationship.

VECM Estimation

Based on the results of the VECM model estimation, the POP variable is the only dependent variable that shows a significant effect in the short term. This is indicated by the significance of the coefficients of the GDPG(-1), CPI(-1), and POP(-1) variables on D(POP), with the t-statistic values each exceeding the limit of ±1.96. Meanwhile, the GDPG, CPI, and OER variables do not show any significant effect from other independent variables, because all of their t-statistic values are below the significance threshold. The highest

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adjusted R-squared value is found in the D(POP) model, which is 0.895756, indicating that around 89% of the variation in population changes can be explained by this model. In contrast, the D(GDPG) and D(OER) models have very low adjusted R-squared values, even negative, indicating that this model is unable to explain the variation in data on both variables well.

Impuls Response Function

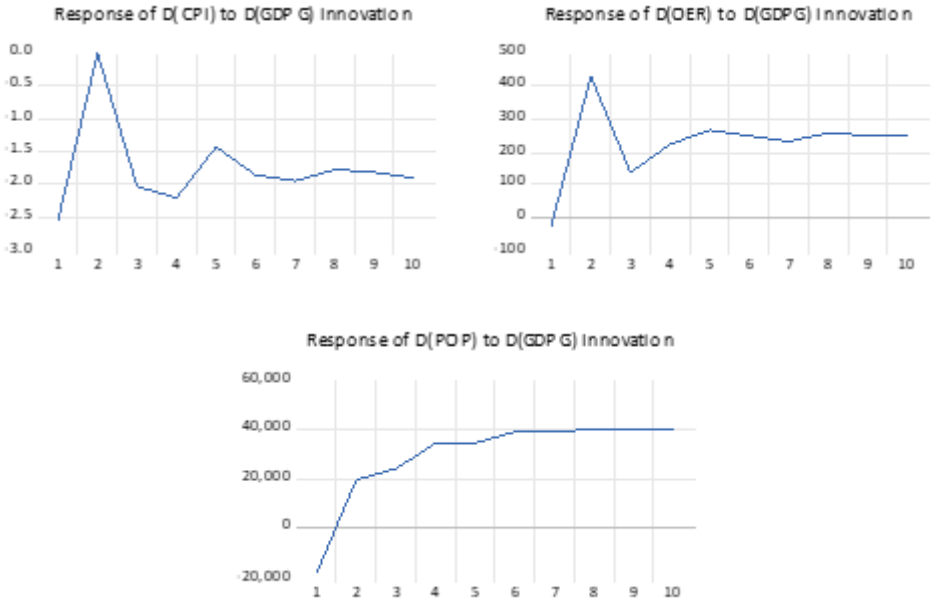

Figure 2. Impulse Response of OER, POP and CPI to GDPG
Source: Data processed by Eviews (2025)

Figure 2 above shows how economic growth (GDPG) responds to shocks from the exchange rate (OER), population (POP), and inflation (CPI). The results show that shocks from inflation and exchange rates have a small and temporary impact on GDPG. The response of GDPG to CPI shocks is relatively flat and quickly returns to equilibrium, indicating that inflation does not have a significant effect on economic growth in the short run. Similarly, shocks from the exchange rate (OER) only provide small fluctuations before returning to stability. In contrast, shocks from population (POP) show a more persistent effect on GDPG, although in a small intensity. This indicates that demographic dynamics play a greater role in influencing economic growth than inflation and exchange rates.

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Figure 3. Impulse Response GDPG, OER dan POP terhadap CPI
Source: Data processed by Eviews (2025)

Figure 3 above illustrates the inflation response (CPI) to shocks from GDPG, OER, and POP. Shocks from GDPG and POP have very little impact on CPI, as seen from the flat response line and quickly returning to zero. However, the CPI response to shocks from OER shows relatively larger fluctuations and persists for several periods. This indicates that changes in the exchange rate can trigger inflation, which is in line with the results of the Granger causality test which shows a two-way relationship between inflation and the exchange rate. Thus, exchange rate stability is important in controlling inflation in Indonesia.

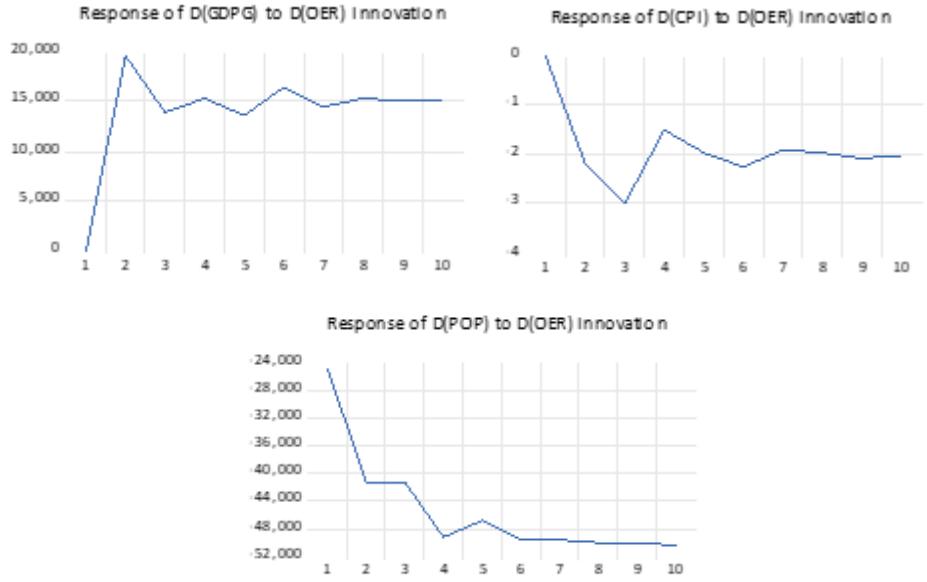

Figure 4. Impulse Response GDPG, POP dan CPI terhadap OER
Source: Data processed by Eviews (2025)

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Figure 4 above shows how the exchange rate (OER) responds to shocks from GDPG, POP, and CPI. Shocks from GDPG and CPI to OER have limited and temporary impacts. However, shocks from population (POP) to the exchange rate show a more pronounced effect, with fluctuations that last longer than other variables. This indicates that demographic pressures, such as population growth, can affect exchange rate stability, for example through increased demand for imported goods or foreign exchange needs.

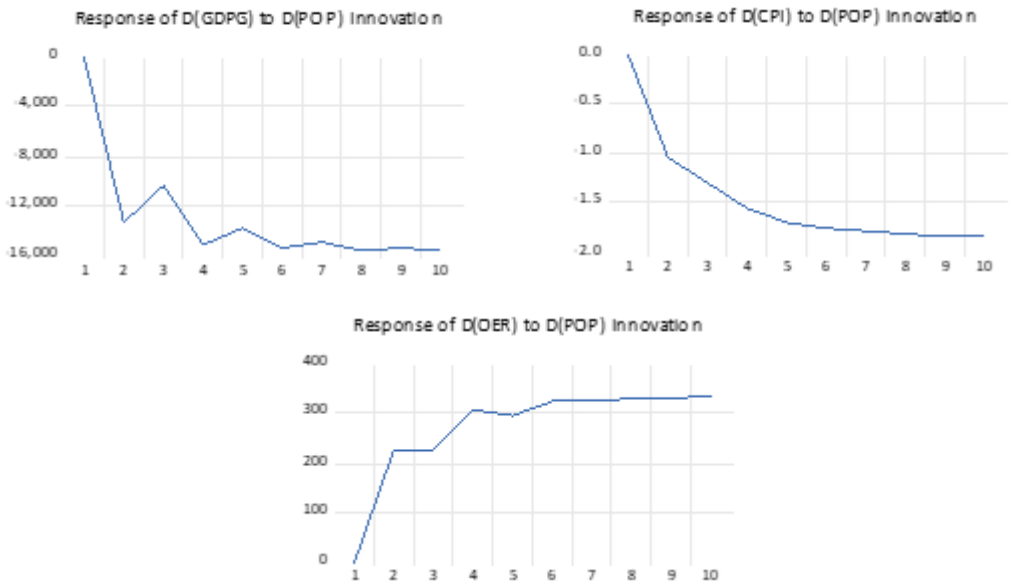

Figure 5. Impulse Response GDPG, OER dan CPI terhadap POP
Source: Data processed by Eviews (2025)

Figure 5 above shows the population response (POP) to shocks from GDPG, OER, and CPI. In general, shocks from these three variables have a very small impact on POP. The responses that appear are flat and quickly return to equilibrium. This shows that the population is more exogenous or not easily affected by short-term fluctuations in economic growth, inflation, or exchange rates. Thus, changes in population are more influenced by structural factors such as birth rates, population policies, or socio-cultural factors than by macroeconomic variables.

Variance Decomposition

Table 8. Variance Decomposition of D(GDPG)

Period	S.E.	D(CPI)	D(GDPG)	D(OER)	D(POP)
1	52260.54	7.375.908	2.624.092	0.000000	0.000000
2	56213.66	7.187.741	2.292.300	5.068.234	0.131361
3	56698.85	7.201.887	2.278.312	5.044.152	0.153861
4	56767.71	7.194.934	2.281.522	5.068.030	0.167146
5	56804.53	7.187.861	2.286.237	5.076.300	0.182700
6	56808.40	7.186.880	2.286.059	5.077.519	0.193087

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7	56816.85	7.185.996	2.286.508	5.080.090	0.203831
8	56819.84	7.184.194	2.286.492	5.081.119	0.212927
9	56824.15	7.183.170	2.286.441	5.082.422	0.221467
10	56827.74	7.182.332	2.286.412	5.083.397	0.229159

Source: Data processed by Eviews (2025)

Table 8 above presents how much variation in economic growth (GDPG) can be explained by CPI, OER, and POP. The results show that the proportion of GDPG variation is mostly explained by CPI (around 7%) and OER (around 5%) in the 10th period, while the contribution of POP is very small (less than 0.3%). The rest, more than 85% of the variation is explained by itself (GDPG). This shows that in the short term, Indonesia's economic growth is more influenced by internal factors inherent in the growth itself, while the influence of other macro variables is relatively limited.

Table 9. Variance Decomposition of D(OER)

Period	S.E.	D(CPI)	D(GDPG)	D(OER)	D(POP)
1	1.626.335	7.099.345	0.855443	2.815.110	0.000000
2	1.707.847	7.285.249	1.391.834	2.553.022	0.225454
3	1.735.498	7.180.831	2.980.752	2.472.707	0.483868
4	1.738.196	7.165.156	3.322.786	2.465.457	0.371085
5	1.743.733	7.120.588	3.322.786	2.455.291	0.918413
6	1.745.986	7.103.630	3.337.887	2.452.017	1.105.642
7	1.748.911	7.081.392	3.419.082	2.448.018	1.285.496
8	1.751.227	7.064.153	3.462.291	2.449.888	1.397.296
9	1.753.457	7.047.440	3.511.136	2.442.093	1.593.356
10	1.755.454	7.032.606	3.552.624	2.439.466	1.726.649

Source: Data processed by Eviews (2025)

Table 9 above shows the sources of variation in the exchange rate (OER). The results show that the largest contributions come from CPI (around 7%) and GDPG (up to 3.5% at the end of the period). Meanwhile, the influence of POP tends to increase gradually from zero to around 1.7% in the 10th period. This shows that the exchange rate is more sensitive to changes in domestic prices and economic growth, and begins to show a response to demographic factors in the medium to long term.

Table 10. Variance Decomposition of D(POP)

Period	S.E.	D(CPI)	D(GDPG)	D(OER)	D(POP)
1	115149.1	6.611.197	3.236.018	5.048.887	8.510.390
2	185552.0	4.881.931	2.038.886	9.281.939	6.543.125
3	224169.0	5.252.672	1.990.911	1.006.655	6.477.167
4	256739.9	5.119.611	2.067.462	1.075.877	6.344.700
5	282877.0	5.155.380	2.083.990	1.110.969	6.289.503
6	304584.2	5.139.106	2.000.524	1.138.623	6.283.737

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7	323274.8	5.140.736	2.110.902	1.154.352	6.220.673
8	339439.4	5.137.826	2.118.566	1.167.511	6.200.141
9	353556.4	5.136.811	2.144.489	1.171.755	6.168.435
10	365966.5	5.135.691	2.129.092	1.185.387	6.171.952

Source: Data processed by Eviews (2025)

Table 10 above shows that the majority of the variation in population (POP) is explained by itself, with a contribution of more than 60%. Other variables such as CPI, GDPG, and OER have smaller contributions, although there is a slight increase in the influence of OER over time. This finding supports the previous conclusion that population tends to be exogenous in the model system and is not much influenced by macroeconomic variables in the short run.

Table 11. Variance Decomposition of D(CPI)

Period	S.E.	D(CPI)	D(GDPG)	D(OER)	D(POP)
1	1.351.491	1.000.000	0.000000	0.000000	0.000000
2	1.463.281	9.527.395	2.291.043	1.810.525	0.003487
3	1.484.234	9.376.919	4.358.020	1.866.510	0.006284
4	1.488.413	9.333.861	4.797.191	1.856.173	0.008030
5	1.489.185	9.324.711	4.882.507	1.862.364	0.008022
6	1.489.358	9.322.269	4.902.019	1.863.016	0.008679
7	1.489.369	9.322.443	4.903.581	1.863.098	0.008895
8	1.489.379	9.322.313	4.904.378	1.863.254	0.009241
9	1.489.382	9.322.285	4.904.375	1.863.271	0.009504
10	1.489.385	9.322.242	4.904.485	1.863.329	0.009763

Source: Data processed by Eviews (2025)

Table 11 above shows that inflation (CPI) is highly influenced by itself, with a contribution of more than 93% up to the 10th period. Although there is a small contribution from GDPG (around 4.9%) and OER (around 1.8%), the impact is still relatively small. POP makes almost no significant contribution to the variation of CPI. This finding suggests that inflation in Indonesia is driven more by internal factors in the price system itself, such as production costs or inflation expectations, rather than by external factors such as economic growth or demographics.

The results of the study indicate that the relationship between inflation (CPI), exchange rate (OER), and population (POP) on economic growth (GDPG) is not linear and is more complex than just a direct causal relationship. In the short term, no significant causal relationship was found between inflation and economic growth, as well as between the exchange rate and economic growth. However, the exchange rate and inflation influence each other, indicating the existence of macroeconomic dynamics that need to be managed simultaneously. Population is proven to have a significant influence on other variables, especially inflation and the exchange rate, which can then indirectly affect economic growth.

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This reflects that demographic pressures in Indonesia have important implications for economic stability.

The VECM estimation results show that inflation (CPI) does not have a significant effect on economic growth in the short term. This finding is in line with Yadgari (2025) who also found that inflation tends to inhibit economic growth, especially if not controlled effectively. High inflation can create uncertainty and reduce people's purchasing power, thus negatively impacting consumption and investment. Although not significant in the short term, inflation remains important to pay attention to in the long term because it can affect macroeconomic stability. Therefore, controlling inflation remains an important focus in maintaining sustainable economic growth.

The estimation results show that the exchange rate does not have a significant effect on Indonesia's economic growth in the short term. This is consistent with the findings of Fuad Hasyim et al. (2023) which states that exchange rate fluctuations have a negative impact on the profitability of Islamic banks, especially when the rupiah depreciates which can affect the smooth payment of debtors' debts. In a macroeconomic context, exchange rate depreciation also risks increasing the price of imported goods, thus potentially suppressing domestic consumption and investment. Although in the VECM model its influence is relatively weak, exchange rate fluctuations still need to be considered considering the openness of the Indonesian economy to global trade and capital flows. A drastic strengthening or weakening of the rupiah can trigger macro instability, especially in sectors that depend on imported raw materials or foreign financing.

This study found that the population variable (POP) has the strongest influence compared to other variables in the model. In the short term, the population is significantly influenced by economic growth and inflation, and has a more persistent impact on other macro variables. This shows that demographic dynamics play an important role in influencing Indonesia's economic stability. These results are in line with the findings of Ochieng et al. (2023) in Kenya which showed a long-term relationship and two-way causality between population and economic growth. They found that population shocks have a positive impact on economic growth for the next nine years. This confirms that population, if managed well, is an important asset for long-term economic growth.

In general, the results of the Impulse Response Function show that shocks from inflation and the exchange rate only have a small and temporary impact on economic growth. Meanwhile, population shows a more sustainable influence. This finding is consistent with the fact that Indonesia's economic growth is greatly influenced by domestic dynamics, including the quantity and quality of human resources.

CONCLUSION

Based on the results of the analysis using the Vector Error Correction Model (VECM), this study confirms the existence of a long-term relationship among inflation, exchange rates, population, and economic growth in Indonesia during the period 1993–2023. In the short run, inflation and exchange rates do not show significant influence on economic growth, while the population variable exhibits a stronger and more persistent effect on other

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macroeconomic variables, including inflation and exchange rate dynamics. The results of the impulse response and variance decomposition analysis indicate that demographic factors, especially population changes, have a more substantial and lasting impact on economic growth compared to monetary indicators such as inflation and exchange rates. These findings suggest that Indonesia's economic development is more influenced by domestic structural variables, particularly demographic dynamics.

Therefore, managing population growth, improving the quality of human capital, and aligning demographic policy with economic planning are crucial to supporting inclusive and sustainable development. Policymakers are encouraged to prioritize investment in education, health, and employment opportunities to harness the potential of the demographic dividend and maintain long-term economic stability.

REFERENCES

Astuti, C. P., & Prasetyanto, P. K. (2022). Analisis Pengaruh Jumlah Penduduk, Inflasi, Dan Nilai Tukar Terhadap Pertumbuhan Ekonomi Pendekatan VECM. *Transekonomika: Akuntansi, Bisnis dan Keuangan*, *2*(6), 225-244.

Badan Pusat Statistik. (2025). *Tingkat inflasi harga konsumen nasional tahun kalender (Y-to-D) (2022=100)*. Diakses dari https://www.bps.go.id/id/statistics-table/1/OTE0IzE=/tingkat-inflasi-harga-konsumen-nasional-tahun-kalender--y-to-d---sup-1--sup---2022-100-.html pada tanggal 14 April 2025.

Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics* (5th ed.). McGraw-Hill.

Kalalo, H. (2016). Analisis faktor-faktor yang mempengaruhi inflasi di Indonesia periode 2000-2014. *Jurnal Berkala Ilmiah Efisiensi*, *16*(1).

Kementerian Perdagangan Republik Indonesia. (2025). *Nilai tukar mata uang asing terhadap rupiah*. Satu Data Perdagangan. Diakses dari https://satudata.kemendag.go.id/data-informasi/perdagangan-dalam-negeri/nilai-tukar pada tanggal 14 April 2025

Krugman, P. R., & Obstfeld, M. (2009). *International economics: Theory and policy*. Pearson Education.

Mankiw, N. G. (2016). *Principles of economics* (7th ed.). Cengage Learning.

Muzakki, L. A. (2024). Analisis Pengaruh Pertumbuhan Ekonomi, Inflasi, Dan Nilai Tukar Mata Uang Asing Terhadap Profitabilitas Bank Umum Syariah Di Indonesia Periode 2016-2020. *Jurnal Ilmiah Ekonomi Islam*, *10*(1), 29-35.

Obere, A., Thuku, G. K., & Gachanja, P. (2013). The impact of population change on economic growth in Kenya.

Syar'iyyah, A. (2022). THE EFFECT OF EXCHANGE RATES, INFLATION AND BI RATES ON PROFITABILITY IN ISLAMIC COMMERCIAL BANKS DURING THE 2016-2022 PERIOD. *Journal of Islamic Economics*, *1*(95), 126-38.

Todaro, M. P., & Smith, S. C. (2020). *Economic development* (13th ed.). Pearson Education.

World Bank. (2024). *Population, total - Indonesia*. World Bank Data. Diakses dari https://data.worldbank.org/indicator/SP.POP.TOTL?locations=ID pada tanggal 14 April 2025.

DOI: https://doi.org/10.54443/sibatik.v4i7.2902

World Bank. (2025). *Pertumbuhan PDB tahunan (%): Indonesia*. Diakses dari https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=ID pada tanggal 14 April 2025.

World Bank. (2025). *GDP growth (annual %) - Indonesia*. Diakses dari https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2023&locations=ID&start=2013 pada tanggal 14 April 2025.

World Bank. (2025). *Official exchange rate (LCU per US$, period average) - Indonesia* Diakses dari https://data.worldbank.org/indicator/PA.NUS.FCRF?locations=ID pada tanggal 14 April 2025.

Yadgari, M. R., & Yadgari, M. Z. (2025). Currency Crosscurrents: Nominal Exchange Rate and US Economic Growth (1960-2024). *Social Science and Human Research Bulletin*, *2*(02), 32-49. https://doi.org/10.55677/SSHRB/2025-3050-0202

DOI: https://doi.org/10.54443/sibatik.v4i7.2902