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# THE RELATIONSHIP BETWEEN MACROECONOMIC VARIABLES IN INDONESIA: STUDY OF ECONOMIC GROWTH, EXPORTS, IMPORTS, LABOR, AND INFLATION

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## ABSTRACT

The objective of this study is to assess the potential for mutual relationships and co-integration among variables such as economic growth, exports, imports, labor, and inflation in Indonesia, using secondary time series data covering the period from 1985 to 2022. The approach applied in this research involves the use of Vector Autoregression (VAR), encompassing Granger Causality and Johansen Co-Integration Test. Subsequently, Vector Error Correction Model (VECM) estimation and forecast analysis are conducted using Impulse Response Function, Variance Error Decomposition, and Forecasting. The results of the Granger Causality test indicate that there is only a unidirectional relationship between economic growth to imports, while there is no significant unidirectional relationship from other variables. The results of the Johansen Co-Integration test suggest that these variables have long-term relationships or are co-integrated. Based on the forecasting results, the research can be applied over the period from 1985 to 2037.

## ARTICLE INFO

*Keywords:*

Granger Causality,
Forecasting,
Macroeconomic,
VAR,
VECM.

## 1.0 INTRODUCTION

Economic development aims to increase a nation's income to drive economic growth and social well-being. Indonesia possesses abundant natural resources, which should be explored as assets to boost economic growth. However, since 1980, Indonesia's economic growth has consistently remained positive, although income levels have grown slowly. Over time, economic growth has become a significant parameter to evaluate a country's development success (Todaro & Smith, 2015).

According to the Solow theory, the accumulation of capital, population growth, and technological progress influence a nation's economic growth (Todaro & Smith, 2015).

The expansion of the workforce creates a large domestic market and strong demand. New technologies, particularly in digital and telecommunications, enhance productivity and job opportunities. International trade provides access to extensive markets, efficiency, and employment prospects. The openness of the financial sector supports foreign capital, capital accumulation, and technology transfer (Salvatore, 2021). Consequently, this combination of factors holds the potential to significantly enhance Indonesia's economic growth, enabling the nation to utilize its natural resources more efficiently and sustainably.

International trade is pivotal to Indonesia's economy, boosting both exports and imports, meeting domestic needs, driving industries, and expanding international market access (Awokuse, 2007). Labor is essential to Indonesia's economic growth. Population growth creates challenges and opportunities for new job opportunities, particularly in the service industry. The government invests in training and education to enhance workforce qualifications (Hashim et al., 2019).The period from 1985 to 2022 holds significant importance for economic growth, trade, labor, and inflation in Indonesia. The country has made strong efforts to fortify its economy and commit to sustainability. Despite facing challenges, Indonesia possesses substantial potential for robust and inclusive economic growth through ongoing economic reforms.

Numerous studies have examined the relationship between exports, imports, labor, inflation, and economic growth as done by (Adu-Gyamfi et al., 2020; Al-Mulali & Sheau-Ting, 2014; Asnawi, 2022; Awokuse, 2007; Budiharto et al., 2018; Funlayo, 2013; Ghazouani et al., 2020; Hashim et al., 2019; Hussain et al., 2019; Islam & Alhamad, 2023; Keho, 2017; Mahmood et al., 2022; Nasreen & Anwar, 2014; Okyere, 2020; Raghutla, 2020; Rahman & Mamun, 2016; Rahman & Vu, 2020; Sahnoun & Abdennadher, 2019; Sebri & Ben-Salha, 2014; Shakeel et al., 2014; Tung, 2021). Understanding the dynamic relationships between economic variables like growth, international trade, labor, and inflation is critical in effective economic policy planning. Granger causality impacts policy outcomes, allowing for a more precise focus. Policy balance is crucial due to the interplay between these variables, such as economic growth influencing labor and inflation. For example, efforts to boost economic growth can affect labor demand, which, in turn, can influence inflation. Therefore, careful consideration is necessary in policy design to ensure balanced and sustainable economic growth (Todaro & Smith, 2015). In the context of understanding Granger causality, the Vector Error Correction Model, and Forecasting, this economic analysis enables the government to formulate prudent policies, ensuring sustainable economic growth and the well-being of the populace.

## 2.0 METHODOLOGY

According to brooks (2003), it is crucial to analyze the interrelationships among variables in a system when dealing with multiple variables in a time series data. Most people believe that the analysis of relationships can be conducted using Vector Autoregression (VAR). VAR is an evolution of Autoregressive Distributed Lag (ARDL), offering flexibility in handling variables treated as exogenous in ARDL. As part of the VAR analysis process, the evaluation of cause-and-effect relationships between economic growth, exports, imports, labor, and inflation is carried out through the application of Granger causality tests. Granger causality tests are beneficial in identifying the direction of the relationship between two variables, particularly in terms of how variable X influences variable Y. This assessment involves examining whether the current value of variable Y can be explained by its own past data and whether the addition of lags of variable X can enhance the model's ability to explain that relationship. The Granger causality equations can be expressed as follows:

$Y_t = \sum_{ai} Y_{t-i} - \sum_{bj} X_{t-j} - \upsilon_t$ ; X cause Y if bj > 0.
$X_t = \sum_{ci} Y_{t-i} - \sum_{dj} X_{t-j} - \upsilon_t$ ; Y cause X if dj > 0.
Where,
$\sum_{ai} Y_{t-i}$ = The lag regression coefficient of all variables Y if X is the dependent variable
$\sum_{bj} X_{t-j}$ = The lag regression coefficient of all variables X if Y is the dependent variable
$\sum_{ci} Y_{t-i}$ = The lag regression coefficient of all variables Y if X is the dependent variable

$\sum_{dj} X_{t-j}$ = The lag regression coefficient of all variables X if Y is the dependent variable
$\upsilon_t$ = Independent random vectors with zero mean and finite covariance matrix

From the results of the regression in the equation above, four possible regression coefficient values can be identified as follows:

1. If, statistically, the total value of the lagged terms ∑ai Yt-i is significantly different from 0, while the total value of the lagged terms ∑bj Xt-j is equal to 0, then there is a unidirectional relationship from Y to X.
2. If, statistically, the total value of the lagged terms ∑ci Yt-i is not significantly different from 0, while the total value of the lagged terms ∑dj Xt-j is different from 0, then there is a unidirectional relationship from X to Y.
3. If, statistically, the total value of the lagged terms ∑ai Yt-i is significantly equal to 0, and the total value of the lagged terms ∑bj Xt-j is equal to 0, there is no relationship between X and Y, either from X to Y or the other way around.
4. If, statistically, the total value of the lagged terms ∑ai Yt-i is significantly not equal to 0, and the total value of the lagged terms ∑bj Xt-j is not equal to 0, there is a two-way causality between Y and X, meaning that both variables mutually influence each other.

The next stage of the analysis involves conducting cointegration tests using the Johansen Cointegration Test. The goal is to identify whether there is a long-term relationship or cointegration between exports, imports, labor, inflation, and GDP. Brooks (2003) explains that short-term imbalances can occur in variables with the same level of stationarity. This means that what is expected by economic actors may not always align with the actual reality, necessitating adjustments. Models that account for these adjustments to correct imbalances are referred to as Error Correction Models.

If cointegration is confirmed, the subsequent analytical step is to perform Vector Error Correction Model (VECM) analysis, which differs from the usual VAR analysis employed when cointegration is absent. To support the findings following the Granger causality and Johansen cointegration tests, further analysis is conducted using impulse response functions, variance error decomposition, and forecasting techniques. Prior to this, an augmented Dickey-Fuller (ADF) test has been conducted.

## 3.0 FINDINGS AND DISCUSSION

### 3.1 Deskriptif Research

In Figure 1, over the period from 1985 to 2022, Indonesia has experienced dynamic economic growth, exports, and imports that reflect its economic journey. Indonesia's economic growth during this period has exhibited diverse trends. In the 1980s through the early 2000s, Indonesia recorded relatively high economic growth, especially during periods of economic expansion and structural reforms. However, there were some economic disruptions, notably during the Asian Financial Crisis in 1997, which had a significant impact on economic growth. Subsequently, Indonesia's economy recovered with stable growth, despite ongoing economic challenges such as commodity price fluctuations and global uncertainties.

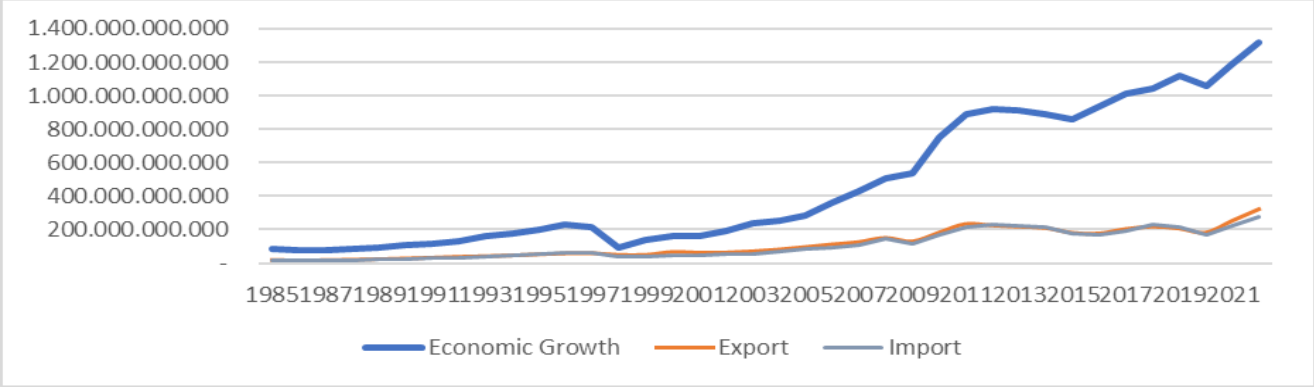

Figure 1. Indonesia's Economic Growth, Export, and Import for the period 1985 – 2022.

In Figure 1, Indonesia's exports and imports also underwent significant developments during this period. As a nation with an open economy, Indonesia expanded its connections in international trade. Key exports such as palm oil, coal, rubber, and other mining products became major contributors to export revenue. Meanwhile, imports encompassed a diverse range of sectors, including consumer goods, machinery, and raw materials. In recent years, the Indonesian government has also focused on import substitution policies to reduce dependence on imports and stimulate domestic economic growth. This period reflects the diverse economic dynamics in Indonesia, marked by efforts to achieve sustainable growth and address economic challenges associated with the ever-changing global market.

In Figure 3, inflation in Indonesia exhibits fluctuations that reflect various economic factors and significant events. At the beginning of this period, inflation in Indonesia was relatively high, especially during the 1980s and early 1990s. Factors such as loose monetary policies, budget deficits, and fluctuations in world commodity prices influenced the rise in inflation rates. In 1997-1998, Indonesia experienced the Asian Financial Crisis, which led to a sharp increase in inflation. However, since then, the government and central bank implemented economic reforms, including inflation control measures, resulting in a gradual decrease in inflation rates to more stable levels for several years ahead. Subsequently, during the following two decades, inflation in Indonesia experienced more controlled fluctuations, even though it still faced challenges from factors like increases in specific commodity prices, changes in government policies, and the impact of global economic turmoil. Throughout this period, inflation tended to stay at lower and more stable levels, illustrating improved efforts in managing price stability. Despite its fluctuations, the inflation trend indicates significant improvements in inflation control from 1985 to 2021, supporting economic growth and overall economic stability in Indonesia.

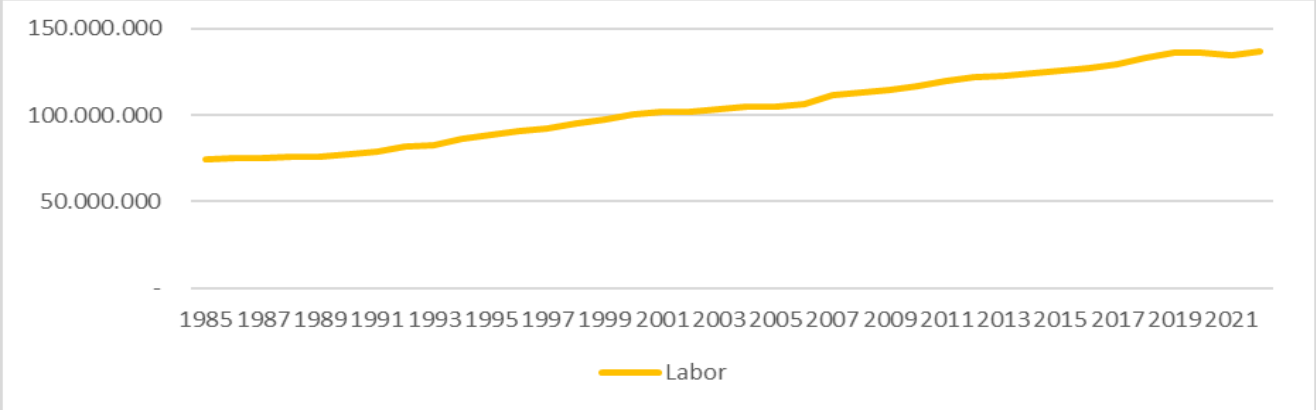


Figure 2. Indonesia's Labor for the period 1985 – 2022,

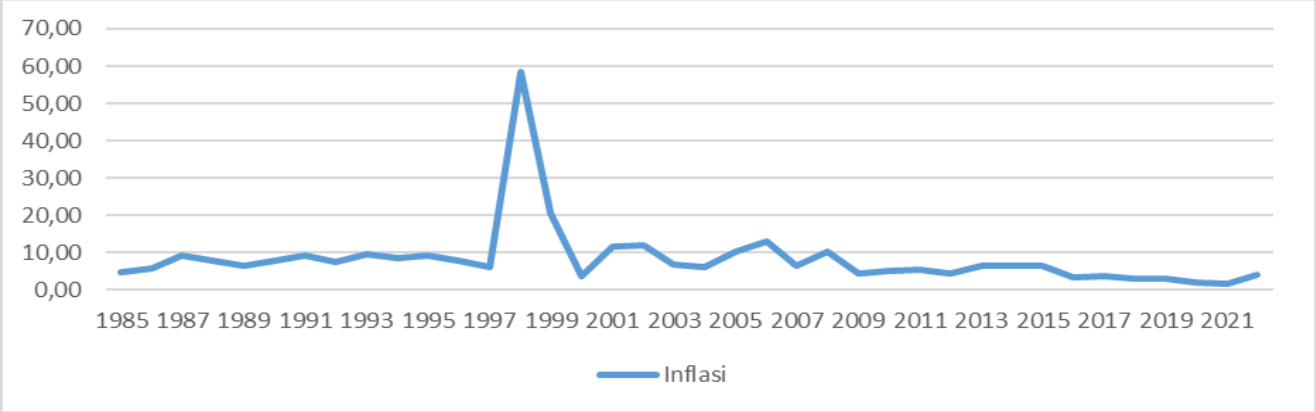


Figure 3. Indonesia's Inflation for the period 1985 – 2022

### 3.2 Unit Root Test

Unit root testing can be conducted using the Augmented Dickey-Fuller (ADF) technique, where the ADF statistic value is compared to the critical values established by MacKinnon. Based on the ADF test results at the level in Table 1, there are results above 0.05 for four variables, whereas in the ADF test in first differences in Table 2, the results are below 0.05, indicating that this study is carried out on first differenced data. The ADF test results are summarized in Table 2. Based on the ADF test, it can be concluded that the probability values at the alpha level are less than 5%, indicating that the variables lgdp, lexport, limport, llabor, and inflation in first differences are suitable for use in VAR or VECM analysis.

Table 1. The results of the Augmented Dickey-Fuller (ADF) test at the level

| Variabel | Level | Probabilitas |
|---|---|---|
| LGDP | Level | 0.9004 |
| LExport | Level | 0.8540 |
| LImport | Level | 0.8015 |
| LLabor | Level | 0.7598 |
| Inflasi | Level | 0.0005 |

Source: Data processing results, conducted using E-Views (October 8, 2023).

Table 2. The results of the Augmented Dickey-Fuller (ADF) test at the first difference level.

| Variabel | Level | Probabilitas |
|---|---|---|
| LGDP | 1st difference | 0.0000 |
| LExport | 1st difference | 0.0000 |
| LImport | 1st difference | 0.0001 |
| LLabor | 1st difference | 0.0023 |
| Inflasi | 1st difference | 0.0000 |

Source: Data processing results, conducted using E-Views (October 8, 2023).

## 3.3 Determination Of The Optimal Lag

Table 3. Results of the Optimal Lag Test.

| Lag | AIC |
|---|---|
| 0 | -4.083056 |
| 1 | -3.886069 |
| 2 | -4.865194 |
| 3 | -4.938150* |
| 4 | -4.856839 |

Source: Data processing results, conducted using E-Views (October 8, 2023).

In the E-Views program, the lag considered as the optimal lag is marked with an asterisk. The test results for the optimal lag in Table 3 indicate that lag 3 has the lowest value in the AIC column. Therefore, lag 3 is chosen as the optimal lag and will be used in all subsequent steps of the VAR analysis.

## 3.4 Causality Granger Test

The Granger test is employed to unveil the direction of the relationships between variables such as lgdp, lexp, limp, llab, and inf. The assessment of these relationships is evaluated by examining the probabilities of each causality test, compared to the significance levels of alpha 0.05 or alpha 0.1. The findings from the analysis in Table 4 reveal intriguing results. Only one variable appears to exhibit a significant one-way influence, which is the economic growth of Indonesia on its import levels. This discovery suggests that changes in Indonesia's economic growth may contribute to fluctuations in import levels. However, the more intriguing result is that the other variables examined in this test do not demonstrate significant causal relationships with each other. This indicates that other factors or external variables may play a more dominant role in explaining the dynamics within the observed system.

Tabel 4. Results of Causality Granger Test

| *Null Hypothesis* | Prob. | Conclusion |
|---|---|---|
| LEXP does not Granger Cause LGDP | 0.7701 | There is no relationship between exports and economic growth. |
| LGDP does not Granger Cause LEXP | 0.2425 | |
| LIMP does not Granger Cause LGDP | 0.9796 | A one-way relationship from economic growth to imports. |
| LGDP does Granger Cause LIMP | 0.0686* | |
| LLAB does not Granger Cause LGDP | 0.5530 | There is no relationship between labor and economic growth. |
| LGDP does not Granger Cause LLAB | 0.6090 | |
| INF does not Granger Cause LGDP | 0.1348 | There is no relationship between inflation and economic growth. |
| LGDP does not Granger Cause INF | 0.1672 | |
| LIMP does not Granger Cause LEXP | 0.2378 | There is no relationship between imports and exports. |
| LEXP does not Granger Cause LIMP | 0.1599 | |
| LLAB does not Granger Cause LEXP | 0.2632 | There is no relationship between labor and exports. |
| LEXP does not Granger Cause LLAB | 0.1758 | |
| INF does not Granger Cause LEXP | 0.1269 | There is no relationship between inflation and exports. |
| LEXP does not Granger Cause INF | 0.5949 | |
| LLAB does not Granger Cause LIMP | 0.1645 | There is no relationship between labor and imports. |
| LIMP does not Granger Cause LLAB | 0.3400 | |
| INF does not Granger Cause LIMP | 0.4300 | There is no relationship between inflation and exports. |
| LIMP does not Granger Cause INF | 0.7387 | |
| INF does not Granger Cause LLAB | 0.4375 | There is no relationship between inflation and labor. |
| LLAB does not Granger Cause INF | 0.5607 | |

Symbol * Indicated at the 10% alpha level.
Source: Data processing results, conducted using E-Views (October 8, 2023).

## 3.5 VAR Model Stability Test

Stability in the Vector Autoregression (VAR) model is crucial because it helps ensure that predictions and the analysis of the impact of shocks on economic variables remain consistent and reliable in the long term. This allows for better decision-making in economic planning and policy. Stability requires that the eigenvalues of the dynamic matrix remain within the unit circle or less than 1. Researchers have calculated the eigenvalues, and all of them were found to be within the circle we observed in Figure 4.

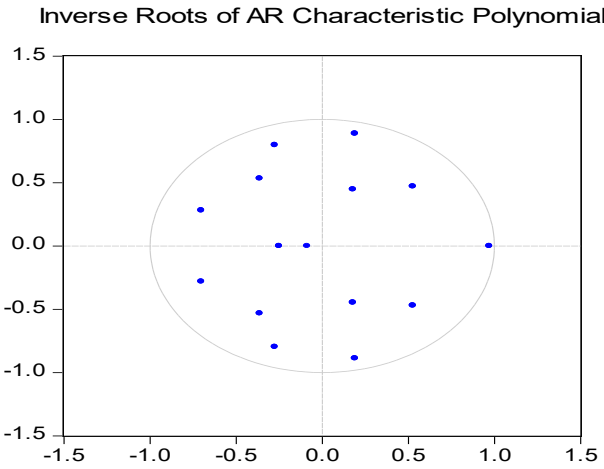


Figure 4. Stability Test for VAR Model

## 3.6 Cointegration Test

Cointegration tests can be conducted using the Johansen technique. The conclusions drawn involve comparing the trace statistic with critical values at a significance level of 5%. Additionally, probabilities are also taken into account to determine the existence of equations within the cointegrated system.

Table 5. Results of Cointegration Test

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.790293 | 104.0385 | 69.81889 | 0.0000 |
| At most 1 * | 0.510535 | 52.49104 | 47.85613 | 0.0172 |
| At most 2 | 0.333650 | 28.91442 | 29.79707 | 0.0629 |
| At most 3 * | 0.270548 | 15.51840 | 15.49471 | 0.0496 |
| At most 4 * | 0.143408 | 5.108182 | 3.841466 | 0.0238 |

Source: Data processing results, conducted using E-Views (October 8, 2023).

The cointegration test results in Table 5 indicate that the Trace Statistic is higher than the critical values at a 5% significance level. This suggests the presence of at least one equation experiencing cointegration within the system. It

depicts a long-term or cointegrated relationship among the five variables: economic growth, exports, imports, labor, and inflation in Indonesia during the period 1985-2022. Therefore, this study can apply VECM analysis.

## 3.7 Significance Test of VECM Estimation Results

Previously, the cointegration test confirmed the existence of a long-term relationship among the four variables. Consequently, the analysis conducted is a Vector Error Correction Model (VECM) analysis. Subsequently, to assess the significance of the lagged effects of a variable within the system, both on itself and on other variables, a significance test is performed using the results of the VECM estimation. The results of the optimal lag test indicated that lag 3 is the most suitable for use in the VECM analysis.

Table 6. Long-term VECM

| Cointegrating Eq: | CointEq1 |
|---|---|
| D(LGDP(-1)) | 1.000000 |
| D(LEXP(-1)) | 0.409377 |
| | (0.34917) |
| | [ 1.17242] |
| D(LIMP(-1)) | -1.196068 |
| | (0.27751) |
| | [-4.31002] |
| D(LLAB(-1)) | -1.921604 |
| | (0.92916) |
| | [-2.06810] |
| D(INF(-1)) | 0.034065 |
| | (0.00476) |
| | [ 7.15454] |
| C | 0.018888 |

Source: Data processing results, conducted using E-Views (October 8, 2023).

To test the significance of variables in the VECM analysis, we refer to the statistical values from the estimation results and compare them to the t-table values at a specific significance level, in this case, 5%. The critical t-table value used is 1.69236, obtained from the statistical table.

Table 7. Short term VECM

| Error Correction: | D(LGDP,2) | D(LEXP,2) | D(LIMP,2) | D(LLAB,2) | D(INF,2) |
|---|---|---|---|---|---|
| CointEq1 | 2.268723 | 1.752046 | 2.644747 | 0.098117 | -150.8060 |
| | (0.98340) | (0.59041) | (0.72593) | (0.06414) | (44.3499) |
| | [ 2.30702] | [ 2.96750] | [ 3.64325] | [ 1.52968] | [-3.40037] |
| D(LGDP(-1),2) | -1.623048 | -1.533155 | -1.864196 | -0.003276 | 58.67599 |
| | (1.01362) | (0.60856) | (0.74824) | (0.06611) | (45.7129) |
| | [-1.60124] | [-2.51933] | [-2.49144] | [-0.04956] | [ 1.28358] |
| D(LGDP(-2),2) | -0.444877 | 0.251347 | 0.601055 | -0.022869 | 32.33600 |
| | (0.61569) | (0.36965) | (0.45449) | (0.04016) | (27.7667) |
| | [-0.72257] | [ 0.67997] | [ 1.32247] | [-0.56947] | [ 1.16456] |
| D(LGDP(-3),2) | 0.034731 | 0.178531 | 0.444388 | -0.032296 | 9.815176 |
| | (0.72056) | (0.43261) | (0.53191) | (0.04700) | (32.4962) |
| | [ 0.04820] | [ 0.41268] | [ 0.83546] | [-0.68717] | [ 0.30204] |
| D(LEXP(-1),2) | -1.111743 | -0.638728 | -0.700327 | -0.052417 | 97.75002 |
| | (1.26654) | (0.76040) | (0.93494) | (0.08261) | (57.1190) |
| | [-0.87778] | [-0.83999] | [-0.74906] | [-0.63451] | [ 1.71134] |
| D(LEXP(-2),2) | -1.752118 | -1.623475 | -1.933971 | 0.017101 | 101.8710 |
| | (1.18949) | (0.71415) | (0.87807) | (0.07759) | (53.6444) |
| | [-1.47300] | [-2.27331] | [-2.20253] | [ 0.22042] | [ 1.89900] |
| D(LEXP(-3),2) | -0.447411 | -0.550503 | -0.565614 | -0.004199 | 45.85092 |
| | (0.73335) | (0.44029) | (0.54135) | (0.04783) | (33.0730) |
| | [-0.61009] | [-1.25033] | [-1.04483] | [-0.08779] | [ 1.38636] |
| D(LIMP(-1),2) | 2.244572 | 1.407956 | 1.790839 | 0.090109 | -162.8243 |
| | (1.44961) | (0.87031) | (1.07008) | (0.09455) | (65.3752) |
| | [ 1.54840] | [ 1.61776] | [ 1.67356] | [ 0.95302] | [-2.49061] |
| D(LIMP(-2),2) | 1.854249 | 1.154823 | 1.472547 | 0.062891 | -125.8954 |
| | (1.24452) | (0.74718) | (0.91868) | (0.08117) | (56.1259) |
| | [ 1.48994] | [ 1.54557] | [ 1.60289] | [ 0.77477] | [-2.24309] |
| D(LIMP(-3),2) | 0.487223 | 0.725331 | 0.634209 | 0.041217 | -45.00841 |
| | (0.94651) | (0.56826) | (0.69870) | (0.06174) | (42.6862) |
| | [ 0.51476] | [ 1.27640] | [ 0.90770] | [ 0.66764] | [-1.05440] |
| D(LLAB(-1),2) | 2.998508 | -2.253895 | -1.308435 | -0.540976 | -281.2417 |
| | (3.29796) | (1.98003) | (2.43451) | (0.21511) | (148.733) |
| | [ 0.90920] | [-1.13832] | [-0.53745] | [-2.51487] | [-1.89091] |
| D(LLAB(-2),2) | 1.132546 | -2.044235 | -3.160108 | -0.610574 | -214.7279 |
| | (4.13020) | (2.47969) | (3.04886) | (0.26939) | (186.266) |
| | [ 0.27421] | [-0.82439] | [-1.03649] | [-2.26647] | [-1.15280] |
| D(LLAB(-3),2) | 4.791652 | -1.188860 | -0.565112 | -0.510316 | -330.6595 |
| | (4.28401) | (2.57203) | (3.16240) | (0.27943) | (193.203) |
| | [ 1.11850] | [-0.46223] | [-0.17870] | [-1.82630] | [-1.71146] |
| D(INF(-1),2) | -0.048986 | -0.053042 | -0.073833 | -0.001574 | 2.248456 |
| | (0.02811) | (0.01688) | (0.02075) | (0.00183) | (1.26776) |
| | [-1.74259] | [-3.14285] | [-3.55804] | [-0.85848] | [ 1.77356] |
| D(INF(-2),2) | -0.024531 | -0.019361 | -0.027427 | -0.000932 | 1.209844 |
| | (0.01542) | (0.00926) | (0.01138) | (0.00101) | (0.69532) |
| | [-1.59106] | [-2.09164] | [-2.40982] | [-0.92687] | [ 1.73998] |
| D(INF(-3),2) | -0.010601 | -0.011633 | -0.014239 | -0.000242 | 0.406757 |
| | (0.01073) | (0.00644) | (0.00792) | (0.00070) | (0.48396) |
| | [-0.98788] | [-1.80568] | [-1.79751] | [-0.34645] | [ 0.84048] |
| C | -0.004455 | -0.006479 | -0.010358 | 0.000722 | -0.022882 |
| | (0.03751) | (0.02252) | (0.02769) | (0.00245) | (1.69147) |
| | [-0.11879] | [-0.28772] | [-0.37414] | [ 0.29525] | [-0.01353] |

Source: Data processing results, conducted using E-Views (October 8, 2023).

In the context of the long-term analysis in Table 6, the results provide several interesting findings regarding the relationships among macroeconomic variables. Firstly, it is observed that, in the long term, exports do not exhibit a significant relationship with economic growth. This raises questions about the actual impact of exports on the economy in the long run and underscores the importance of other factors that may contribute to economic growth. Secondly, concerning imports and labor, a long-term relationship is found, though it is relatively weak. These results indicate that changes in import levels and the workforce can affect long-term economic growth, even though their influence tends to be modest.

However, the most notable finding pertains to inflation. The analysis results show a strong relationship between the inflation rate and long-term economic growth. This suggests that changes in the inflation rate have a significant impact on a country's economic development in the long term. This raises questions about the economic policy strategies employed to manage inflation and how changes in the inflation rate can affect overall economic stability.

Based on Table 7, several crucial aspects of the short-term relationships between various macroeconomic variables in Indonesia are revealed. First, there is a significant short-term relationship between economic growth and export and import variables at lag 1. This indicates that fluctuations in exports and imports directly impact economic growth in the short term. Furthermore, it is evident that exports also have a short-term relationship at lag 1 with the inflation variable. This suggests that export fluctuations might affect the inflation rate in the short term. Additionally, at lag 2, exports also exhibit a short-term relationship with import and inflation variables, indicating that export fluctuations can impact imports and inflation rates in the longer term. On the other hand, imports at lag 1 have a short-term relationship with exports and inflation, and at lag 2, imports also have a short-term relationship with inflation.

This implies that fluctuations in imports can affect exports and inflation in the short term. Labor, in this analysis, only has a short-term relationship at lag 3 with inflation. This may indicate that other factors such as economic growth, exports, and imports play a more significant role in labor fluctuations in the short term. Finally, the inflation variable at lag 1 has a short-term relationship with economic growth, exports, and imports. However, at lag 2 and lag 3, short-term relationships are only observed with exports and imports, indicating that inflation might directly impact exports and imports in the short term.

## 3.8 The Impulse Response Function (IRF) Analysis

Image 5 depicts the IRF graph for each variable as its response. The IRF analysis using economic growth as a response shows that in the next 15 years, the highest response is economic growth responding to itself, and this is expected to remain stable at a standard deviation level above 10 percent. Meanwhile, in the IRF analysis with exports as the response, the highest response is exports responding to themselves, and this is expected to remain stable at a standard deviation level above 5 percent. The IRF analysis with imports as a response shows the highest response is economic growth responding to imports, stable at a standard deviation level above 10 percent. In the IRF analysis with labor as a response, the highest response is exports responding to economic growth, and this is expected to remain stable at a standard deviation level above 1 percent. Finally, the IRF analysis with inflation as a response indicates the highest response is exports responding to inflation, stable at a standard deviation level above 2 percent over the next 15 years.

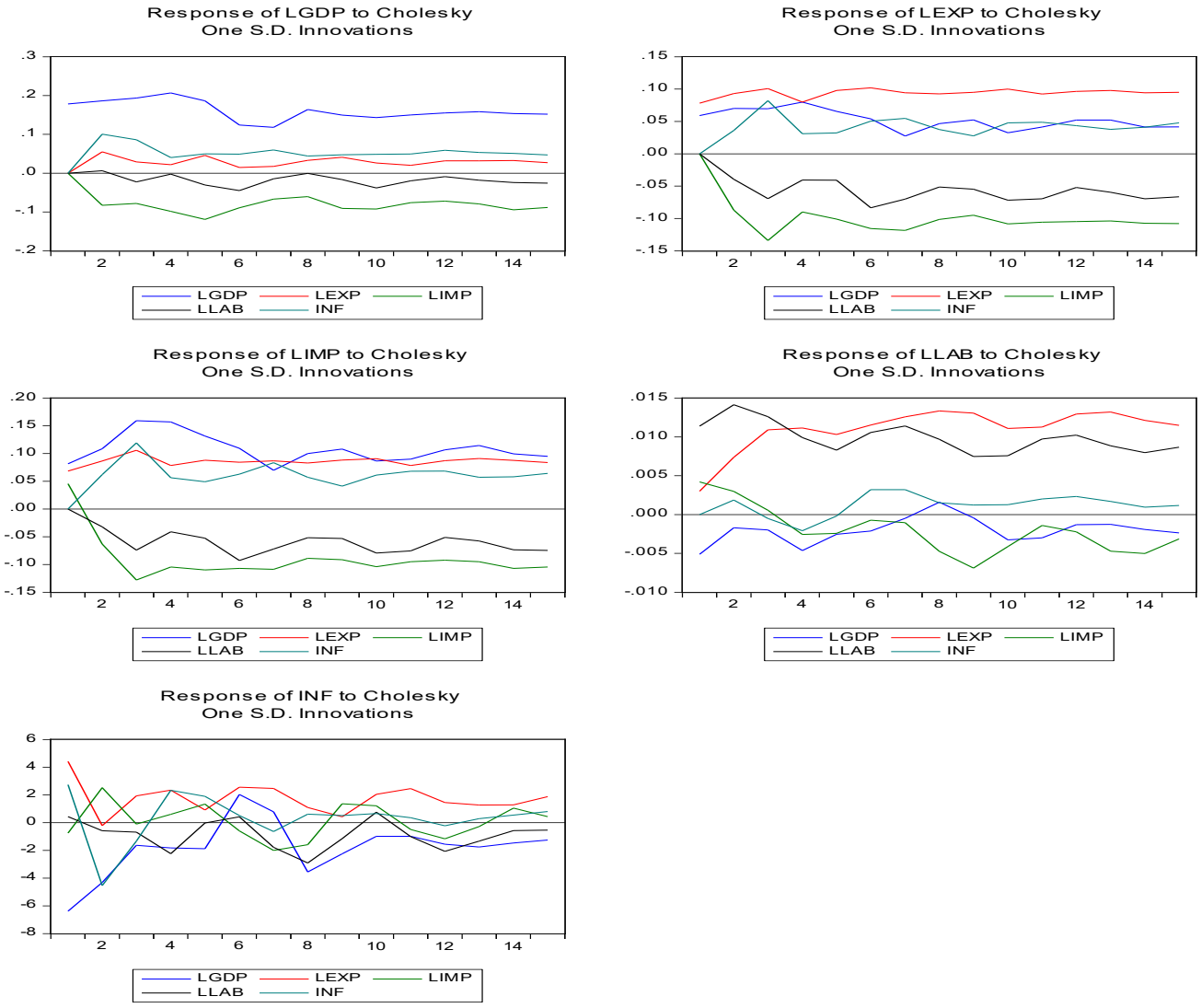


Figure 5. Impulse Response Function Graph

## 3.9 The Variance Error of Decomposition Analysis

In Figure 6, it is evident that the movement of the variance error decomposition graph will mutually influence the contributions between variables each year. The results of the VD in Figure 3 for the next 15 years provide varying scenarios, but each variable contributes to the others. GDP is influenced by itself with a contribution of 65%, indicating internal stability in economic growth. Imports make a significant contribution of 35% to exports in Indonesia. Subsequently, economic growth also contributes 35% to imports in Indonesia. Furthermore, exports contribute 45% to labor. Economic growth has a very high contribution, specifically 43%, to inflation in Indonesia.

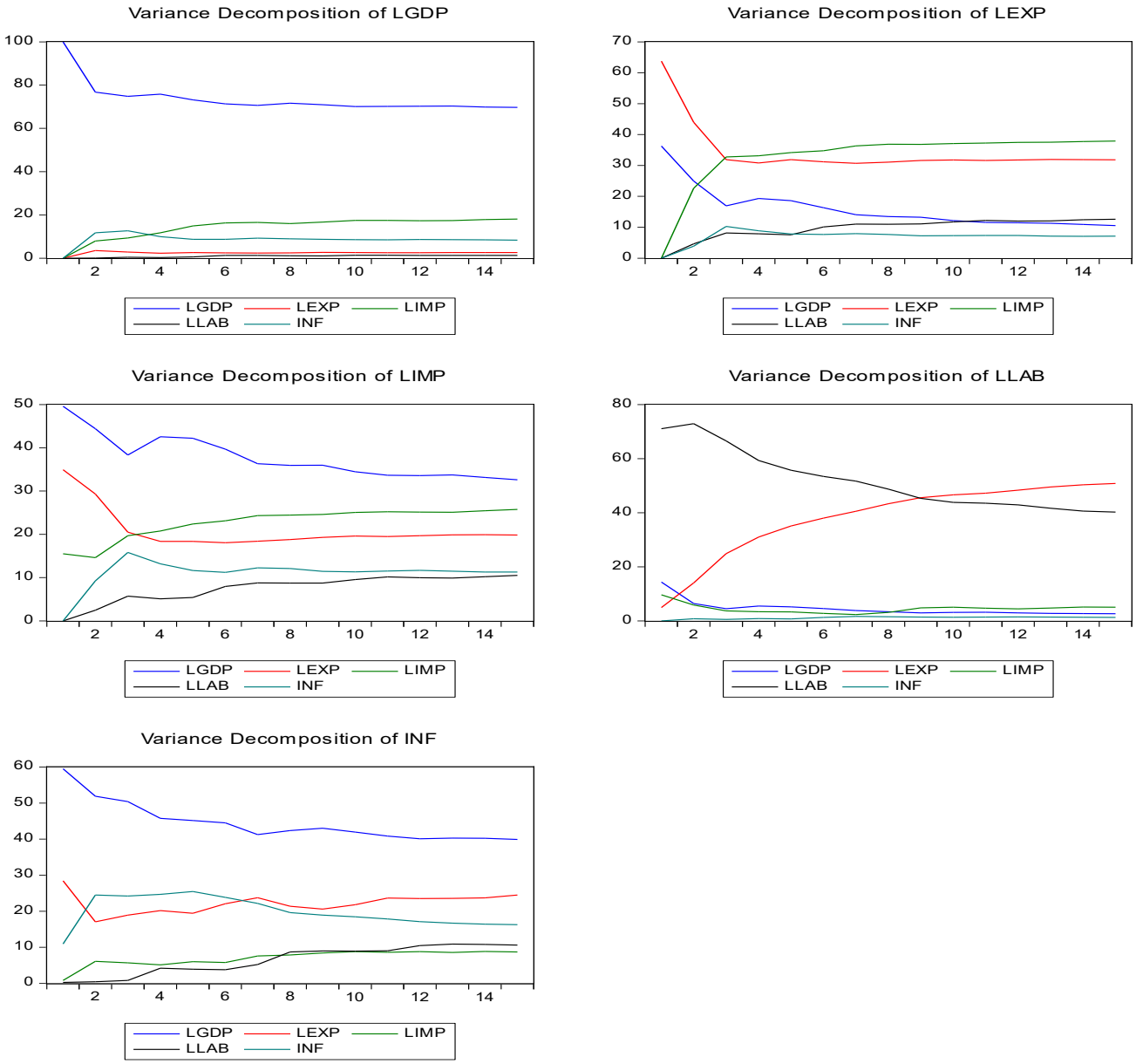


Figure 6. Variance Error of Decomposition Graph

## 3.10 Data Forecasting

In this study, we conducted forecasts based on the VECM(3) model, which is considered the best model for analyzing the dynamic relationships between economic growth, exports, imports, labor, and inflation data. The VECM(3) model was employed to forecast the behavior of these variables for the next 15 periods, as presented in Table 8 and Figure 6.

The results of the forecasting analysis using the VECM(3) method reveal several interesting findings. Firstly, in terms of economic growth, there are initial fluctuations, but a tendency for growth is observed over the next 15 years. This

suggests the potential for a stable economic recovery in the long term. Secondly, looking at exports, a sustained upward trend is evident for the next 15 years. This can be interpreted as an indication that export activities will continue to increase in the coming years, potentially contributing positively to economic growth. Thirdly, imports display annual fluctuations but also show a tendency for growth over the next 15 years. This could reflect an increase in import activities in the economy, signaling strong long-term economic growth. Fourthly, considering labor trends, the forecasting results indicate stable annual increases. Finally, when considering inflation, the forecast suggests that inflation will experience significant and irregular fluctuations over the next 15 years.

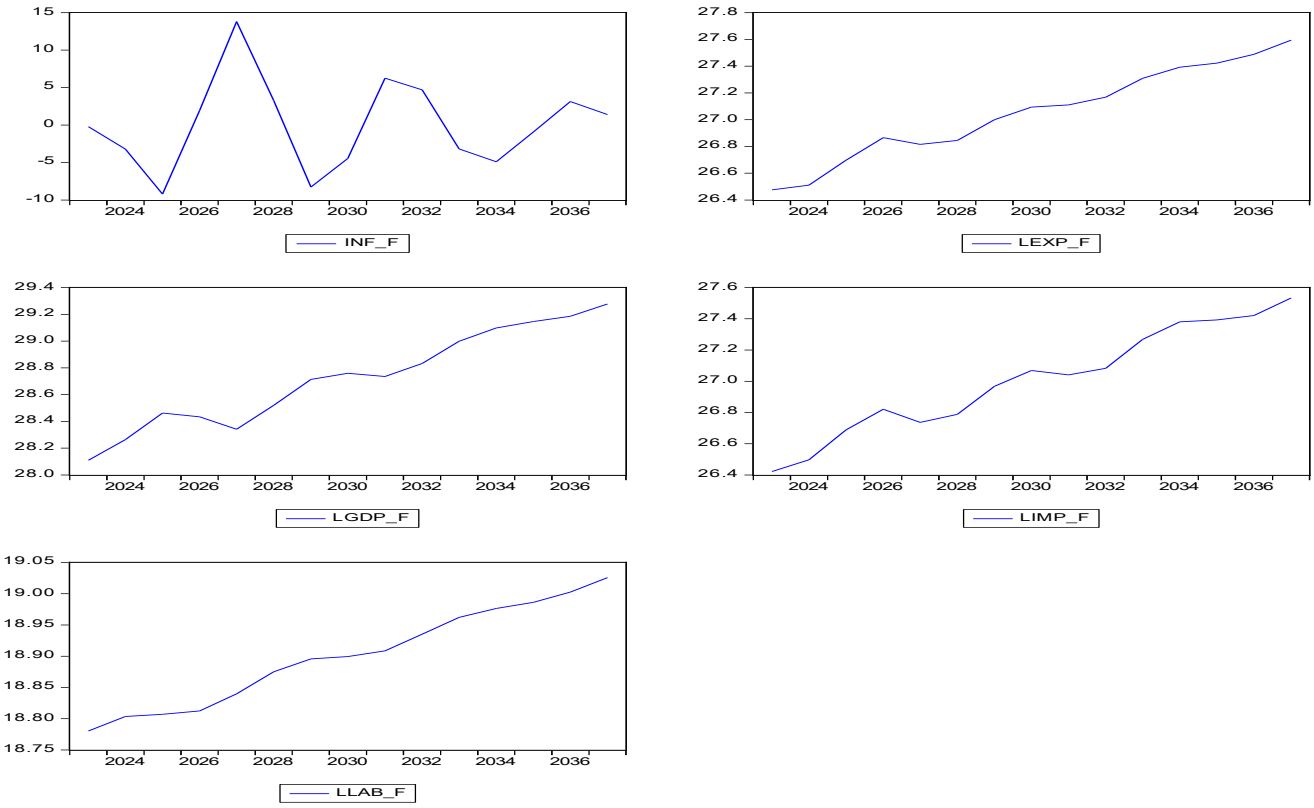


Figure 6. Forecasting Graph periode 2023 to 2037 in Indonesian.

In the context of public policy, these forecasting results can assist the government in designing policies that support sustainable economic growth, job creation, and price stability. They can also serve as a tool for assessing the impact of specific policies on key economic variables. Overall, the forecasting analysis using the VECM(3) model provides valuable insights into the economic dynamics in the years to come.

Table 8. Data Forecasting periode 2023 to 2037 in Indonesian.

| Variable / Year | LGDP | LEXP | LIMP | LLAB | INF |
|---|---|---|---|---|---|
| 2023 | 28.11 | 26.48 | 26.42 | 18.78 | -0.23 |
| 2024 | 28.26 | 26.51 | 26.50 | 18.80 | -3.20 |
| 2025 | 28.46 | 26.70 | 26.69 | 18.81 | -9.20 |
| 2026 | 28.43 | 26.87 | 26.82 | 18.81 | 1.97 |
| 2027 | 28.34 | 26.82 | 26.74 | 18.84 | 13.81 |
| 2028 | 28.52 | 26.85 | 26.79 | 18.88 | 3.25 |
| 2029 | 28.71 | 27.00 | 26.97 | 18.90 | -8.28 |
| 2030 | 28.76 | 27.09 | 27.07 | 18.90 | -4.46 |
| 2031 | 28.74 | 27.11 | 27.04 | 18.91 | 6.26 |
| 2032 | 28.83 | 27.17 | 27.08 | 18.94 | 4.70 |
| 2033 | 29.00 | 27.31 | 27.27 | 18.96 | -3.19 |
| 2034 | 29.10 | 27.39 | 27.38 | 18.98 | -4.89 |
| 2035 | 29.15 | 27.42 | 27.39 | 18.99 | -0.92 |
| 2036 | 29.19 | 27.49 | 27.42 | 19.00 | 3.13 |
| 2037 | 29.28 | 27.59 | 27.53 | 19.03 | 1.41 |

Source: Data processing results, conducted using E-Views (October 8, 2023).

## 4.0 CONCLUSION

The Granger Causality test results revealed that among the five variables, namely economic growth, exports, imports, labor, and inflation, none of them exhibited causal relationships with each other. However, a unidirectional relationship was identified from economic growth to imports in Indonesia during the period from 1985 to 2022. Additionally, the Johansen Co-Integration Test confirmed cointegration among these five variables. The Impulse Response Function (IRF) and Variance Error Decomposition (VD) analyses indicated that economic growth significantly influences exports and imports.

Among these four variables, namely exports, imports, labor, and inflation, long-term relationships with economic growth in Indonesia were identified. There are several variables that exhibit long-term relationships with each of these variables. The factors influencing economic growth in this country are highly complex and interconnected. It's challenging to pinpoint a simple cause-and-effect relationship among these variables due to the myriad of other factors impacting Indonesia's economy, such as global commodity price fluctuations, government policies, and external factors. In this context, it is crucial for the government and policymakers to adopt a holistic and diversified approach to strengthen economic growth. This includes economic diversification, investment in human resources and infrastructure, as well as careful inflation management. While there is no dominant one-way relationship, a deep understanding of the intricate interactions among these variables is key to effective and sustainable economic policy planning.

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