JPEB Vol. 8, No. 2, 2023, pp: 99-110

Jurnal Penelitian Ekonomi dan Bisnis

journal homepage: http://jpeb.dinus.ac.id

Macroeconomics Linkages on Indonesian Economic Growth: A Granger Causality Analysis

Mochammad Yusuf[1]✉

[1]Economic Development Department, Faculty of Economics, Universitas Negeri Semarang, Indonesia

Article Information

Article history:
Accepted: June 2023
Approved: August 2023
Published: September2023

Keywords:
Causality, ECM, Economic Growth, Macroeconomics, Trade Openness

Abstract

Macroeconomic indicators and trade performance constitute vital elements in the holistic development of developing nations. The tumultuous effects stemming from government policies, economic crises, and the pandemic-induced disruptions have posed significant challenges for countries worldwide. The core objective of this research is to delve into the intricate relationships between macroeconomic variables and trade growth within the context of Indonesia, employing the Error Correction Model and Granger Causality approaches. According to the findings of this study, inflation and exchange rates exert a noteworthy adverse influence on long-term economic growth. In contrast, trade and foreign investment exhibit a substantial positive impact on economic growth, both in the short and long run. Furthermore, the evidence discerned suggests a bidirectional relationship between inflation and economic growth, while foreign investment and the exchange rate maintain a unidirectional association with Indonesian economic growth. Based on the insights gleaned from this study, it is advisable that governments in these nations implement measures and policies aimed at managing the real exchange rate, stabilizing inflation, and safeguarding economic growth.

How to Cite: Yusuf, M. (2023). Macroeconomics Linkages on Indonesian Economic Growth: A Granger Causality Analysis. Jurnal Penelitian Ekonomi dan Bisnis, 8(2), 99-110. doi:https://doi.org/10.33633/jpeb.v8i2.7875

✉correspondence address:
Economic Development Department, Faculty of Economics, Universitas Negeri Semarang, Indonesia
E-mail: mochammady@students.unnes.ac.id

ISSN
2442-5028 (print)
2460-4291 (online)
DOI: 10.33633/jpeb.v8i2.7875

INTRODUCTION

Inflation and economic growth are fundamental elements of the macroeconomy that constantly occupy the thoughts of policymakers worldwide (Obradovic et al., 2017). Inflation and economic growth can also provide an evidence-based overview of a country's economic stability and can relay economic downturn (Sezer et al., 2016). nflation occurs when there is a sustained increase in the price level in an economy over a given period. This increase can be attributed to a variety of factors, including aggregate demand and supply dynamics, as well as external influences like technological advancements that impact people's spending habits. (Kojo Edeme, 2015). Menurut teori inflasi yang dikembangkan oleh Friedman (1963) states that the main factor triggering inflation is the money supply.

Indonesia, being one of the most populous developing countries, has prompted the government to be particularly vigilant about inflation volatility through numerous economic stabilization measures. Over the period from 1986 to 2022, Indonesia's inflation rate remained relatively stable, averaging around 10%. However, it faced a monetary shock, especially during the Asian monetary crisis in 1998, which led to hyperinflationary conditions with an annual average inflation rate of 58.14%. Due to the pandemic and the resulting economic activity restrictions, Indonesia's inflation rate remained relatively low in 2020-2021, at 1.92% and 1.56%, respectively, but began to rise, reaching 5.42% in 2022. Figure 1 provides a detailed overview of Indonesia's inflation trend from 1986 to 2022.

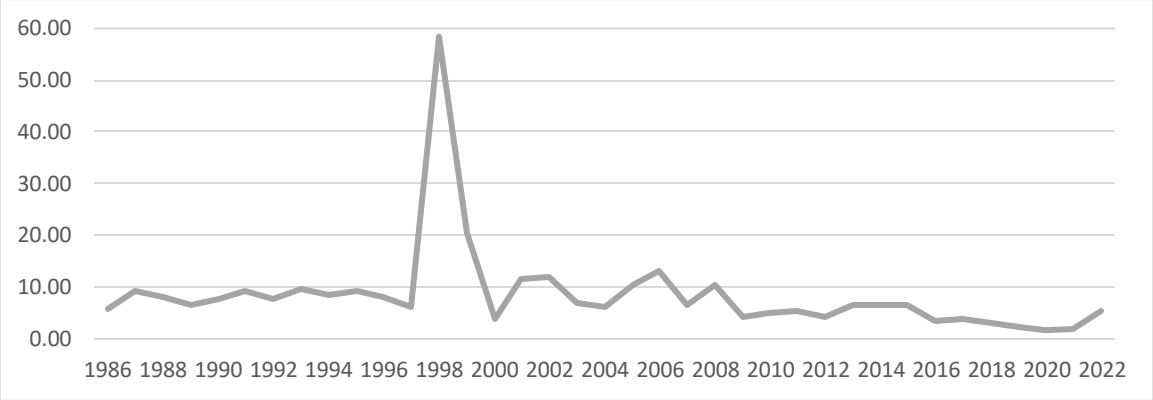


Figure 1.
Indonesia's Annual Trend of Inflation (CPI) for 1986-2022
Source: International Monetary Fund; Bank Indonesia, 2022 (Processed)

The relationship between real GDP growth and inflation is critical for policymakers, who are responsible for taking appropriate actions and solutions to deliver sustainable increases in living standards (Salim & Fadilla, 2021). Testing the link between economic growth and inflation is also one of the main issues in the field of macroeconomics. One of the questions being debated scientifically is the true direction of the relationship between inflation and economic growth (Shahbaz, 2013). From a Keynesian point of view, a higher rate of inflation is usually associated with a decrease in the unemployment rate, which in turn should contribute to higher economic growth. According to Keynesian economics, inflation affects economic growth and can have an impact on an unequal allocation of resources, especially if it is rather high. On the other hand, Friedman (1963), argues that inflation is, first of all, a monetary phenomenon and has no impact on real economic variables. In other words, an increase in the money supply is thought to lead to an increase in prices rather than an increase in the rate of economic growth. Therefore, this issue has become one of the debates on macroeconomic issues, the results of which are still controversial.

Furthermore, economic growth is also not only influenced by inflation but by a variety of complex economic and non-economic factors. The exchange rate is one of the factors that influence economic growth. According to Ismanto et al. (2019), the exchange rate has a negative relationship with economic growth. A decline in the exchange rate has an impact on output decline and will affect GDP and this is in line with the Mundell-Fleming theory because, in an open economy, inflation (imports) and unstable exchange rates tend to be affected by negative export performance (Putra, 2022). The unemployment rate is also one of the triggers for the slowdown in the economy because it represents the non-optimal working force contributing to an increase in economic

output. Foreign investment has also proven capable of increasing economic growth, according to Ridha & Parwanto (2020), This is in line with the endogenous growth model which states that the economy will grow through technological improvements brought by other countries to economic activities carried out in the country of origin. Trade openness is also suspected to be one of the factors affecting economic growth. According to Keho (2017), openness to trade negatively affects growth in countries with low financial development but has an insignificant impact in countries with high financial development. Trade openness is conducive to economic growth in countries with low inflation, but has no significant impact on growth in countries with high inflation (Noureddine & Ozcan, 2020)

This study was structured to fill in the gaps in the literature regarding the linkages between macroeconomic variables on economic growth in Indonesia, as well as answer the inconsistencies in the results of previous studies. Furthermore, this study will also provide long-term and short-term modeling to estimate the attachment of macroeconomic indicators to economic growth to provide more empirical results as a basis for policy formulation by the government in regulating the inflation rate and the inclusiveness of Indonesia's economic growth. The main novelty of this research lies in the use of the Engle Granger Error Correction Model, aimed at delivering more empirical research findings. Previous studies predominantly focused on one-directional effects, offering research findings that can be further developed.

METHOD

This study aims to examine the intricate relationship between macroeconomic indicators and economic growth in Indonesia. It endeavors to elucidate the connections, both in the short-term and long-term, between macroeconomic indicators and economic growth within the Indonesian context. To achieve this, the study employs two distinct econometric approaches, which aim to furnish empirical insights into the correlation between macroeconomic indicators and economic growth in Indonesia. In its initial approach, the study employs the Engle-Granger error correction model to gauge the impact of macroeconomic variables on economic growth, both in the short run and over an extended time horizon. Subsequently, the analysis proceeds to employ the Granger causality approach to investigate the attachment or causal relationships among economic growth indicators. The dataset used in this research comprises time-series data for Indonesia, spanning the years from 1986 to 2021, sourced from reputable institutions such as the World Bank, the International Monetary Fund, and the Indonesian Central Bureau of Statistics. For greater clarity, Table 1 provides detailed operational definitions of the variables employed in this study:

Table 1. Variables Operational Definition

Variable	Description	Unit
Gross Domestic Product	The total added value of goods and services produced by various production units in a country within 1 year	Billion IDR
Inflation (CPI)	An index that calculates the average change in the price of a package of goods and services consumed by households in a certain period. CPI is an indicator used to measure the inflation rate.	Percentage
Unemployment	The percentage of the number of unemployed to the total labor force.	Percentage
Exchange Rate	The exchange rate of the Rupiah against the world's recognized currency is US$.	IDR
Foreign Direct Investment	The amount of capital to do business in the territory of the Republic of Indonesia is carried out by foreign investors, both those who use foreign capital completely and those who jointly with domestic investors.	Billion IDR
Trade Openness	The proportion of trade volume to gross domestic product.	Percentage

Source: Worldbank, IMF, dan BPS Indonesia, 2022 (Processed)

To explain the relationship between health and economic growth in Indonesia, this study uses a quantitative approach using one of the econometric methods, namely the Engle-Granger Error Correction Model. The Engle-Granger Error Correction Model is used to carry out the analysis process because this model can provide complete information about dynamic short-term and long-term relationships between variables integrated

with the research model (Astuti & Saputro, 2018). The basic model, or long-term capital Engle-Granger ECM, is formulated as follows:

$$\mathbf{LogGDP_t} = \beta_0 + \beta_1 INF_t + \beta_2 Unemp_t + \beta_3 LogExc_t + \beta_4 LogFDI_t + \beta_5 TO_t + e_t \quad (1)$$

Selanjutnya, model dasar diubah menjadi bentuk erorr correction model, atau model jangka pendek, sebagai berikut:

$$\mathbf{D(LogGDP)_t} = \alpha_0 + \alpha_1 D(INF)_t + \alpha_2 D(Unemp)_t + \alpha_3 D(LogExc)_t + \alpha_4 D(LogFDI)_t + \alpha_5 D(TO)_t + e_t \quad (2)$$

Where GDP is Indonesia's gross domestic product, INF is the annual inflation rate, Unemployment is the unemployment rate, Exc is the rupiah exchange rate against the United States dollar, FDI is foreign investment, TO is trade openness obtained through a comparison between trade volume and domestic product gross, e and ε is the residue, t is the time. β0, β1, β2, β3, β4, β5 are parameters for the long-term model, α0, α1, α2, α3, α4, α5 are parameters for ECM, D is the difference between the Nt observations and the Nt-1 observations.

The conditions of the Engle-Granger Error Correction model are (1) all variables are not stationary at level, I (0); (2) all variables are stationary at the first difference, I(1); (3) all variables must be integrated (Cointegration), (4) and in the short-term estimation model the value of ECT (-1) must be negative and significant (Gujarati. D. N., 2004). The stationary test was performed using the Augmented Dickey-Fuller (ADF) unit root test and the cointegration test was carried out using the Engle-Granger Cointegration test for residues. The Engle and Granger cointegration test is carried out by running the base model using OLS, and then testing whether the residuals in the estimated equation are at rest at a level or

First difference was conducted by using the Augmented Dickey Fuller test (Nachrowi, 2006). If the residual is stationary at level, I (0), it indicates that the variables in the integrated model or all variables in the model have a long-term relationship or long-term equilibrium relationship between the variables in the model. If these three conditions are met, ECM analysis can be used. In estimating the relationship of economic variables, there is often a shock condition, especially in the short term, which can cause disequilibrium, the Engle-Granger ECM model is used to detect how large and fast the short-term relationship adjustment of cointegrated variables is to return to a condition of rebalance. (Studentmund, 2016).

The second analysis method is Granger Causality. Granger Causality analysis is used to determine the relationship between the dependent variable and the independent variable and the opposite effect, or what is often known as a two-way reciprocal relationship (Purnomo, 2001). The Granger Causality Model can produce an empirical result of influence between research variables by making all variables in the study independent variables as well as dependent (Shojaie & Fox, 2021). The first step that must be done is to select the optimum lag. In order to be able to develop a time series data analysis model through a good VAR model, determining the time lag becomes very influential and important (Bressler & Seth, 2010). In the autoregressive model, time lag has an important role in determining the results of the analysis, so time lag is something that must be paid close attention to. The procedure for determining the optimal lag length can be done by looking at the Schwarz Criterion (SC), Akaike Information Criterion (AIC), Final Prediction Error (FPE), and Hannan-Quinn (HQ) values. The time lag that has the most asterisks in determining the lag length criterion is the optimal lag level in the model (Bressler & Seth, 2010). After determining the optimum lag length, Granger Causality analysis can be carried out. The econometric model of the Granger Causality analysis method is as follows:

$$X_1 = \sum_{i=1}^{m} a_i X_{t-i} + \sum_{j=1}^{n} b_j Y_{t-j} + \mu_t \quad (3)$$

$$Y_1 = \sum_{i=1}^{r} C_i Y_{t-i} + \sum_{j=1}^{s} d_j X_{t-j} + v_t \quad (4)$$

Where u_t and v_t represent the error terms which in the model are assumed to contain serial correlation and m=n=r=s. Through the regression results of the two equations above, 3 possible patterns of relationship can be obtained as a result of the values of the respective regression coefficients. First, namely, a bidirectional relationship when independents had a significant effect on the dependent and vice versa. Second, the relationship is

Unidirectional, that is, if the dependent has a significant effect on independents or independents have a significant effect on the dependent. The third is that there is no causal effect relationship if both independents to dependent or vice versa.

RESULT AND DISCUSSION

Presently, the economic growth of numerous countries worldwide confronts turbulence and uncertainty within the economic landscape, driven by various factors, primarily the enduring Covid-19 pandemic that has persisted for over two years. Mobility restrictions and economic activity constraints constitute social repercussions that all nations must contend with, and the pandemic has left its mark on the volatility of macroeconomic indicators as well. Indonesia, as a developing nation, grapples with analogous challenges in its pursuit of sustainable economic recovery and the fostering of economic growth.

Previous literature extensively explored the impact of macroeconomic variables such as inflation, unemployment rates, exchange rates, and foreign investment on economic growth. This study integrates the dimension of a country's trade performance, which is suspected of being a catalyst for economic upheavals in Indonesia, especially in the context of the monetary crisis and the pandemic. Therefore, this study also incorporates trade openness as an explanatory variable, with the overarching objective of delivering an empirical elucidation of the influence and interconnection between macroeconomic indicators and economic growth in Indonesia.

Table 2. Unit Root Test for Level and 1st Difference

Variables	Unit root test in level	Unit root test in 1st difference level
Log (PDB)	0.0897	0.0000
INF	0.1134	0.0002
TP	0.3950	0.0006
Log (NT)	0.4811	0.0000
Log (PMA)	0.1641	0.0000
KP	0.0710	0.0000

Source: Data Processed, 2023

Based on the results of the unit root test in table 2, it can be seen that at the level I(0) all variables in the study have a probability value of $\alpha<0.05$ so all variables are not stationary at that level. Whereas in the first difference, the probability value of all variables is below the value of $\alpha> 0.05$, so it can be concluded that all variables are stationary at the first difference. This shows that this model has fulfilled the first requirement of the Engel-Grenger Error correction model, the next step of analysis is to carry out a cointegration test.

Table 3. Cointegration Test

		T-statistic	Prob.
ADF test statistic		-5.737315	0.0000
Test Critical Values	1% level	-3.632900	
	5% level	-2.948404	
	10% level	-2.612874	

Source: Data Processed, 2023

The results of the cointegration test in Table 3 indicate that the ADF test statistic surpasses the critical value thresholds at significance levels ranging from 1 to 10 percent, and the probability value falls below the α (alpha) threshold of 5 percent. As a result, it can be inferred that the residual variance is stationary at the I (0) level. The cointegration test further demonstrates that all variables within the model have undergone integration, indicating the presence of a long-term relationship in this model. Consequently, the cointegration test findings confirm the fulfillment of the third prerequisite for employing the Engle-Granger error correction model. The subsequent phase involves an analysis of the long-term impact estimation of the model using the Engle-Granger Error Correction Model methodology.

Table 4. Long-Term Estimation of Error Correction Model

Dependent: Gross Domestic Product			
Variable	**Coefficient**	**T-Statistics**	**Prob.**
Constant	21.95200	17.01861	0.0000***
INF	-0.018368	-4.214173	0.0002***
TP	-0.059558	-1.638001	0.1115
Log (NT)	-0.913541	-14.45120	0.0000***
Log (PMA)	0.243259	7.550698	0.0000***
KP	0.847180	3.074896	0.0044***
Adjusted R^2		0.954249	
Prob F-Stat		0.000000	

Note: *Significance at α<10%; ** significance at α<5%; *** significance at α<1%
Source: Data Processed, 2023

Based on the outcomes of the long-term error correction model estimation presented in Table 4, it can be deduced that if all independent variables remain at zero, the economic growth, as indicated by the Gross Domestic Product (GDP), would amount to 21,952 billion rupiahs. Making the ceteris paribus assumption, it becomes evident that in the long term, inflation exerts a significant negative impact on economic growth. Specifically, a 1% increase in inflation leads to a 0.018% reduction in economic growth. Likewise, the exchange rate also hinders economic growth; a 1 rupiah increase in the exchange rate results in a 0.91% decrease in economic growth. Foreign investment is identified as a driver of economic growth. A 1% increase in foreign investment corresponds to a 0.24% increase in economic growth. Moreover, an uptick in trade openness contributes positively to long-term economic growth, with a 1% increase in trade openness associated with an 0.81% boost in economic growth. Nevertheless, the unemployment rate negatively affects economic growth in the long term. The adjusted R^2 value for the long-term model stands at 0.847180, indicating that all independent variables considered in this study collectively account for 84.7% of the variation in the impact on economic growth. Furthermore, the probability value of the F-Stats is determined to be 0.000, signifying that all the independent variables in this study simultaneously influence long-term economic growth.

Table 5. Short-Term Estimation of Error Correction Model

Dependent: Gross Domestic Product			
Variable	**Coefficient**	**T-Statistics**	**Prob.**
Constant	0.065798	2.635573	0.0135**
INF	-0.002101	-0.534985	0.5969
TP	-0.027216	-0.749679	0.4597
Log (NT)	2.379870	0.788102	0.4373
Log (PMA)	0.068412	2.796340	0.0092***
KP	0.603159	3.881880	0.0006***
ECT_{t-1}	-0.100958	-2.081310	0.0467**
Adjusted R^2		0.621932	
Prob F-Stat		0.000061	

Note: *Significance at α<10%; ** significance at α<5%; *** significance at α<1%
Source: Data Processed, 2023.

Table 5 explains the outcomes of the short-term error correction model estimation. According to the results, the Gross Domestic Product (GDP) would amount to 0.065798 billion rupiahs if all the independent variables were set to zero. Under the ceteris paribus assumption, it becomes apparent that foreign investment exerts a significant positive influence on economic growth. Specifically, a 1% increase in foreign investment is associated with a 0.06% rise in GDP, serving as an indicator of economic growth.

Similarly, an uptick in trade openness also contributes positively to short-term economic growth. A 1% increase in trade openness corresponds to a 0.60% increase in economic growth. However, in the short term, both inflation and the unemployment rate exhibit negative effects on economic growth, although these effects are not statistically significant. Moreover, it is noteworthy that the exchange rate has a positive impact on economic growth in Indonesia in the short term, albeit not statistically significant.

ECT_{t-1} coefficient shows the speed of adjustment towards equilibrium and is negative and statistically significant explaining the convergence from the short term to the long term. A velocity of 0.100958 means that 10.09% of this imbalance is corrected within 1 year. The value of adjusted R^2 is known to be 0.621932, this means that all independent variables in the capital can explain 62.19% of the variation in the short-term effect of economic growth. Furthermore, the probability value of the F-Stats is known to be 0.000, which means that all the independent variables in this study simultaneously affect economic growth in the short term.

Atigala et al. (2022) developed an endogenous growth model to explain the link between economic growth and inflation in Sri Lanka, his research yielded empirical findings that inflation, both in the long and short term, would slow down the rate of economic growth. However, some literature such as research conducted by Ekinci et al. (2020), states that in developed countries the effect of inflation on economic growth is non-linear. Iqbal & Nawaz (2010) added that the non-linear relationship between inflation and economic growth means that inflation in the short term may be able to boost the pace of the economy, but if it continues to occur in the long term it will harm the economy. Kusumatrisna et al. (2022), stated that in Indonesia the impact of inflation on economic growth tended to be felt more in eastern Indonesia than in the western region, especially during a pandemic outbreak.

The results of this study supported previous findings by Nagel (2015) who also found that the unemployment rate would slow down the rate of economic growth. Mădălina-Gabriela et al. (2017), adding that there is a trade-off between economic growth and unemployment, it is explained that in Nigeria an increase in the unemployment rate by 1 percent will reduce the rate of economic growth by 0.5 percent. Kukaj (2018), added that the unemployment rate will have a significant impact in the long term because if there is an increase in unemployment in the long term it will affect the level of consumption so that economic activity decreases which in turn slows down the pace of economic growth. This is consistent with the findings of this study, where the effect of the unemployment rate is only significant in the long-term model, whereas in the long-term model the relationship is not significant.

In the long run, an increase in the rupiah exchange rate will slow economic growth in Indonesia. The same result was found by Putra (2022) by using the error correction model, in the short term the exchange rate does not have a significant effect on economic growth, but in the long term, there is a significant positive effect. According to Karahan (2020), a high exchange rate indicates a weakening in the value of a country's currency and will have an impact on the country's international trade performance. The weakening of the exchange rate will make exports more expensive so export demand will decrease which will affect the country's balance of payments, which will eventually slow down economic growth (Morina et al., 2020).

The findings of this study indicate that both the long and short term have a significant positive impact on economic growth. In line with this, similar results were also found by Ayenew (2022), in Sub-Saharan Africa. According to Ridha & Parwanto (2020) increased foreign investment will improve infrastructure and human resource development by providing better training for local workers, and encouraging the creation of new jobs, leading to higher per capita income and household savings. Furthermore, (Sukar et al. (2011), added that foreign investment can provide beneficial spillover effects for recipient countries such as technology spillover, human resource development, international trade integration, job creation, and creating a competitive environment for companies.

Trade openness in this study is proven to have a significant positive effect both in the long term and in the short term on economic growth in Indonesia. Similar results were also found in Nigeria through research conducted by Oppong-Baah et al. (2022), by using the pooled ordinary least squares (POLS) model. Fatima et al. (2020), argue that trade liberalization encourages specialization in sectors that have economies of scale that contribute to increased efficiency and productivity in the long run. The new endogenous growth model explains the positive relationship between trade openness and economic growth as a result of the international diffusion of advanced technologies (Silajdzic & Mehic, 2016). Furthermore, the ratio and composition of international trade also need to be taken into account in an effort to boost the rate of economic growth, the government must be able to control the number of imports so that it does not exceed exports while at the same time maintaining the intensity of international trade activities with other countries through reducing trade barriers. (Osei et al., 2019). To obtain more empirical results, the second stage of analysis was carried out, namely Granger Causality to determine the

attachment or causality between variables. The first stage in carrying out the Granger Causality test is determining the optimum lag shown in table 6 below.

Table 6. Lag Optimum Selection Criteria

Lags	LogL	LR	FPE	AIC	SC	HQ
0	-530.1989	NA	5229123.	32.49691	32.76900	32.58846
1	-358.8002	270.0829	1484.600	24.29092	26.19557	24.93178
2	-287.2602	86.71511*	217.0011	22.13698	25.67418	23.32714
3	-238.6324	41.26000	202.0314	21.37166	26.54141	23.11112
4	-146.1453	44.84221	41.10118*	17.94820*	24.75051*	20.23697*

*Indicates lag order selected by the criterion
Source: Data Processed, 2023

Based on the optimum lag selection test, it is known that lag (-4) is the optimal lag length for this research model, which is indicated by the highest number of asterisks compared to other lag levels. By using the lag length (-4), Granger Causality analysis can be carried out which is shown in table 7 below.

Table 7. Hasil Estimasi Granger Causality

Null Hypothesis	Obs	F-Stats	Probability
INF does not Granger Cause LPDB	33	21.1330	0.0001***
LPDB does not Granger Cause INF		4.52959	0.0075***
TP does not Granger Cause LPDB	33	1.00493	0.4244
LPDB does not Granger Cause TP		0.09813	0.9820
PMA does not Granger Cause LPDB	33	0.66733	0.6209
LPDB does not Granger Cause PMA		4.54019	0.0071***
LKP does not Granger Cause LPDB	33	0.22011	0.9246
LPDB does not Granger Cause LKP		1.07046	0.3928
NT does not Granger Cause LPDB		84.8605	0.0008***
LPDB does not Granger Cause NT	33	1.48365	0.2384

Source: Data Processed, 2023

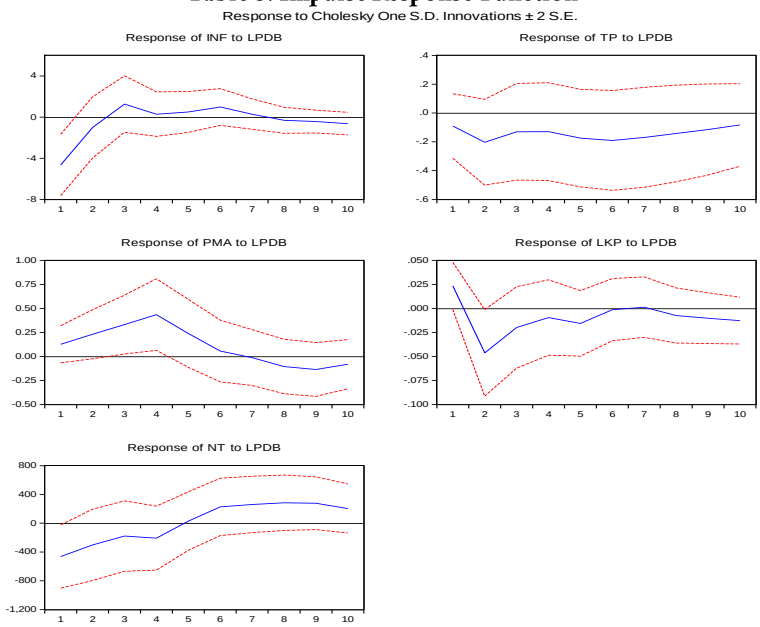
The results of the Granger causality estimation yield empirical insights revealing a causal relationship, specifically a bidirectional one, between economic growth represented by Gross Domestic Product (GDP) and the inflation rate. This is substantiated by both probability values falling below α> 0.05. Additionally, economic growth and foreign investment exhibit a unidirectional relationship, whereby an increase in economic growth stimulates linear growth in foreign investment. Moreover, economic growth is found to be influenced by exchange rates, as Table 7 illustrates a unidirectional relationship between exchange rates and economic growth..

The findings of this study are in line with Singh & Amar (2015), found causality between inflation and economic growth in Japan using the Granger Causality method. This result is in line with the findings of Fischer (1983), who was the first researcher on the topic of the relationship between inflation and economic growth, Fisher specifically added that in the short term, an increase in inflation will boost the rate of economic growth, but as the increase occurs it can also reduce the rate of economic growth due to a non-linear relationship pattern. On the other hand, Sahnoun & Abdennadher (2019), found a unidirectional relationship between inflation and economic growth with a negative direction of influence. Jayathileke & Rathnayake (2013), added that developing countries such as Indonesia will be more vulnerable to supply shocks that cause high inflation variability and disruption of consumption, investment, and production behavior. Furthermore, similar results were also found by Richardson & Rana (2018) Economic growth can indeed stimulate foreign direct investment, but foreign investment is not capable of significantly propelling economic growth. The results from the aforementioned estimations elucidate a unidirectional relationship between exchange rates and economic growth. According to Tan et al. (2021),

exchange rate movements can affect the rate of economic growth, but economic growth is not able to affect the exchange rate significantly.

To obtain more empirical findings, an Impulse Response Function (IRF) analysis is used to look at the shock response of inflation, unemployment, foreign investment, exchange rates, and trade openness to the gross domestic product as a proxy for economic growth. According to Kirchner (2022) by using the Impulse Response Function, it can be seen how long the shock effect is experienced by the income per capita variable. The vertical line shows the magnitude of the response given when the shock occurs, while the horizontal line shows the period or how long the response is given when the shock occurs. (Beyer & Farmer, 2021)

Table 8. Impulse Response Function



Source: Data Processed, 2023

The analysis of the impulse response function results yields significant empirical insights. In the short term, a notable response to an inflation increase of 1 percent is observed within 1-3 years, but in the long term, it tends to normalize with relatively stable volatility. Conversely, the unemployment rate generates a negative shock in both the short and long term, with a range of shock between -1 to -2 percent. Foreign investment introduces a substantial economic shock within the first 1-4 years, amounting to 0.25%. Similarly, trade openness imparts a shock of -0.25 percent in the short term, but this effect stabilizes in the long term. Notably, the exchange rate exerts a significant impact on economic growth, both in the short and long term. In the short term, the exchange rate produces a considerable shock during the initial 4 years, and this effect continues to amplify in the long term. These findings also indicate that in the long term, the value of the rupiah exchange rate will persistently appreciate.

CONCLUSION AND RECOMMENDATION

The empirical findings derived from the error correction model estimations provide valuable insights. In the long term, it is evident that inflation and exchange rates exert a significant adverse influence on economic growth, while foreign investment and trade openness have a significant positive impact. In contrast, in the short term, only foreign investment and trade openness exhibit a significant positive effect on economic growth. Furthermore, the Granger Causality test reveals a causal relationship between inflation and economic growth. Furthermore, foreign investment and the exchange rate maintain a unidirectional relationship with the economic growth of Indonesia.

Drawing from the conclusions of this study, it is imperative for the governments of these nations to institute policies and measures geared towards the management of real exchange rates and trade dynamics to safeguard economic growth. In light of the volatility in inflation, these governments should proactively implement a series of policies aimed at controlling inflation, given its detrimental impact on economic growth. Moreover, trade policies

need to be designed to foster investment in capital-intensive sectors and facilitate the development of human capital capable of assimilating technology from more developed nations.

REFERENCES

Astuti, P. Y., & Saputro, D. R. S. (2018). Kointegrasi dan Estimasi Error Correction Model (ECM)- Engle-Granger. *Seminar Nasional Pendidikan Matematika Ahmad Dahlan*, 131–135.

Atigala, P., Maduwanthi, T., Gunathilake, V., Sathsarani, S., & Jayathilaka, R. (2022). Driving the pulse of the economy or the dilution effect: Inflation impacting economic growth. *PLoS ONE*, *17*(8 August), 1–17. https://doi.org/10.1371/journal.pone.0273379

Ayenew, B. B. (2022). The effect of foreign direct investment on the economic growth of Sub-Saharan African countries: An empirical approach. *Cogent Economics and Finance*, *10*(1). https://doi.org/10.1080/23322039.2022.2038862

Beyer, A., & Farmer, R. E. A. (2021). A Method to Generate Structural Impulse-Responses for Measuring the Effects of Shocks in Structural Macro Models. In *European Central Bank Working Paper No. 586*. https://doi.org/10.2139/ssrn.878686

Bressler, S. L., & Seth, A. K. (2010). Wiener – Granger Causality : A well established methodology. *NeuroImage*. https://doi.org/10.1016/j.neuroimage.2010.02.059

Ekinci, R., Tuzun, O., & Ceylan, F. (2020). The relationship between and economic growth: Experiencing some inflation targeting countries. *Econstor*, *24*(1 (87)), 6–20.

Fatima, S., Chen, B., Ramzan, M., & Abbas, Q. (2020). The Nexus Between Trade Openness and GDP Growth: Analyzing the Role of Human Capital Accumulation. *SAGE Open*, *10*(4). https://doi.org/10.1177/2158244020967377

Fischer, S. (1983). Inflation and Growth. In *NBER Working Paper* (No. 1235).

Friedman, M. (1963). *Inflation: Causes and Consequences*. Asia Publishing House.

Gujarati. D. N. (2004). *Basic Econometrics* (4th edition (ed.)). McGraw-Hill Companies.

Hayat, M. A., Ghulam, H., Batool, M., Naeem, M. Z., Ejaz, A., Spulbar, C., & Birau, R. (2021). Investigating the Causal Linkages among Inflation, Interest Rate, and Economic Growth in Pakistan under the Influence of COVID-19 Pandemic: A Wavelet Transformation Approach. *Journal of Risk and Financial Management*, *14*(6), 277. https://doi.org/10.3390/jrfm14060277

Iqbal, N., & Nawaz, S. (2010). Investment , Inflation and Economic Growth Nexus. *The Pakistan Development Review*, *2*(4).

Ismanto, B., Kristiani, M. A., & Rina, L. (2019). Pengaruh Kurs dan Impor Terhadap Pertumbuhan Ekonomi Indonesia Periode Tahun 2007-2017. *Jurnal Ecodunamika*, *2*(1), 1–6. https://ejournal.uksw.edu/ecodunamika/article/view/2279

Jayathileke, M. B., & Rathnayake. (2013). Testing the Link between Inflation and Economic Growth: Evidence from Asia. *Modern Economy*, *04*(02), 87–92. https://doi.org/10.4236/me.2013.42011

Karahan, Ö. (2020). Influence of Exchange Rate on the Economic Growth in the Turkish Economy. *Financial Assets and Investing*, *11*(1), 21–34. https://doi.org/10.5817/fai2020-1-2

Keho, Y. (2017). The impact of trade openness on economic growth: The case of Cote d'Ivoire. *Cogent Economics and Finance*, *5*(1), 51–61. https://doi.org/10.1080/23322039.2017.1332820

Kirchner, J. W. (2022). Impulse Response Functions for Nonlinear, Nonstationary, and Heterogeneous Systems, Estimated by Deconvolution and Demixing of Noisy Time Series. *Sensors*, *22*(9). https://doi.org/10.3390/s22093291

Kojo Edeme, R. (2015). Savings, Inflation and Economic Growth Linkages: A Re-Examination with Nigeria Data. *Journal of Investment and Management*, *4*(5), 180. https://doi.org/10.11648/j.jim.20150405.16

Kukaj, D. (2018). Impact of Unemployment on Economic Growth: Evidence from Western Balkans. *European Journal of Marketing and Economics*, *1*(1), 10. https://doi.org/10.26417/ejme.v1i1.p10-18

Kusumatrisna, A. L., Sugema, I., & Pasaribu, S. H. (2022). Threshold Effect in the Relationship between Inflation and Economic Growth in Indonesia. *Buletin Ekonomi Moneter Dan Perbankan*, *25*(2), 117–132. https://doi.org/10.21098/bemp.v25i1.1045

Mădălina-Gabriela, A., Anghelache, C., & Manole, A. (2017). The Effect of Unemployment on Economic Growth. *Romanian Statistical Review*, *7*(7), 174–186. https://doi.org/10.9790/5933-1003018289

Morina, F., Hysa, E., Ergün, U., Panait, M., & Voica, M. C. (2020). The Effect of Exchange Rate Volatility on Economic Growth: Case of the CEE Countries. *Journal of Risk and Financial Management*, *13*(8), 177. https://doi.org/10.3390/jrfm13080177

Nachrowi, N. (2006). *Pendekatan Populer dan Praktis Ekonometrika untuk Analisis Ekonomi dan Keuangan*. (1st editio). lembaga penerbit fakultas ekonomi universitas indonesia.

Nagel, K. (2015). Relationships between unemployment and economic growth – the review (results) of the theoretical and empirical research. *Journal of Economics and Management*, *20*(2), 65–79.

Noureddine, R., & Ozcan, O. (2020). Does Trade Openness Contribute To Economic Growth and Development of Morocco ? *Journal of Economics, Business, & Organization Research*, *3*, 443–453.

Obradovic, S., Sapic, S., Furtula, S., & Lojanica, N. (2017). Linkages between inflation and economic growth in Serbia: An ARDL bounds testing approach. *Engineering Economics*, *28*(4), 401–410. https://doi.org/10.5755/j01.ee.28.4.14003

Oppong Baah, T., Bo, Y., Twi Brempong, C., Amoah, E. O., Prempeh, N. A., & Addai, M. (2022). The Impact of Trade Openness on Economic Growth: The Case of Ghana and Nigeria. *Journal of Human Resource and Sustainability Studies*, *10*(01), 142–160. https://doi.org/10.4236/jhrss.2022.101010

Osei, D. B., Sare, Y. A., & Ibrahim, M. (2019). On the determinants of trade openness in low- and lower–middle-income countries in Africa: how important is economic growth? *Future Business Journal*, *5*(1). https://doi.org/10.1186/s43093-019-0002-8

Purnomo, D. (2001). penggunaan metode granger untuk uji kausalitas. *Jurnal Ekonomi Pembangunan*, *2*(1), 91–100.

Putra, F. A. (2022). Pengaruh Ekspor , Impor , dan Kurs terhadap Pertumbuhan Ekonomi di Indonesia. *Growth: Jurnal Ilmiah Ekonomi Pembangunan*, *1*(2), 124–137.

Richardson, K., & Rana, I. (2018). The Relationship between Foreign Direct Investment and Economic Growth in Emerging Economies. *Proceedings of the 8th International Conference on Innovation & Management*, *3*(2), 1269–1273. https://doi.org/10.21081/ax0198

Ridha, M. R., & Parwanto, N. (2020). The Effect of Foreign Direct Investment, Human Development and Macroeconomic Condition on Economic Growth: Evidence from Indonesia. *Journal of Indonesian Applied Economics*, *8*(2), 46–54. https://doi.org/10.21776/ub.jiae.2020.008.02.5

Sahnoun, M., & Abdennadher, C. (2019). Causality Between Inflation, Economic Growth and Unemployment in North African Countries. *Economic Alternatives*, *1*, 77–92.

Salim, A., & Fadilla. (2021). Pengaruh Inflasi Terhadap Pertumbuhan Ekonomi Indonesia Anggun Purnamasari. *Ekonomica Sharia: Jurnal Pemikiran Dan Pengembangan Ekonomi Syariah*, *7*(1), 17–28. www.bps.go.id,

Sezer, F., Bali, Ö., & Gürol, P. (2016). Journal of Economics Bibliography. *Journal of Economics Bibliography*, *3*(1S), 63–73. Fuzzy MULTIMOORA, Warehouse Selection, Hazardous Materials

Shahbaz, M. (2013). Linkages between inflation, economic growth and terrorism in Pakistan. *Economic Modelling*, *32*(1), 496–506. https://doi.org/10.1016/j.econmod.2013.02.014

Shojaie, A., & Fox, E. B. (2021). *Granger Causality : A Review and Recent Advances* (Issue 1969). University of Washington.

Silajdzic, S., & Mehic, E. (2016). Trade Openness and Economic Growth: Empirical Evidence from Transition Economies. *Intech*, *11*, 13. https://www.intechopen.com/books/advanced-biometric-technologies/liveness-detection-in-biometrics

Singh, S., & Amar. (2015). Causal nexus between inflation and economic growth of Japan. *Iranian Economic Review*, *19*(3), 265–278.

Studentmund. (2016). *Using Econometrics: A Practical Guide* (7th editio). Pearson.

Sukar, A., Ahmed, S., & Hassan, S. (2011). The effects of foreign direct investment on economic growth: The case of Sub-Sahara Africa. *Southwestern Economic Review*, *12*(2), 61–73.

Tan, L., Xu, Y., & Gashaw, A. (2021). Influence of Exchange Rate on Foreign Direct Investment Inflows: An Empirical Analysis Based on Co-Integration and Granger Causality Test. *Mathematical Problems in Engineering*, *2021*. https://doi.org/10.1155/2021/7280879