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CAUSALITY ANALYSIS OF INDONESIA'S EXTERNAL DEBT WITH VECTOR AUTOREGRESSION (VAR) APPROACH

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Abstract

The Indonesian government faces significant problems in terms of development funding due to the lack of adequate financial resources. Therefore, as a developing country, Indonesia is forced to take action by spending a large amount of money to promote growth and implement various development initiatives through foreign debt policies. The formulation of this research problem is whether there is an interaction relationship between exports, imports, inflation, exchange rates and foreign exchange reserves with Indonesia's foreign debt. This study aims to analyze the interaction relationship between exports, imports, inflation, exchange rates and foreign exchange reserves with Indonesia's foreign debt. This research was conducted using quantitative research methods. The sampling technique used is purposive sampling with the number of samples to be taken based on an assessment of the completeness of this research data, namely from 2015 to 2022 there are 96 samples. The research method uses the Vector Autoregression (VAR) approach using the Eviews 12 program. The Granger test shows that there is no two-way causality relationship between exports, imports, inflation, exchange rates and foreign exchange reserves with Indonesia's external debt. However, there is cointegration in the study so that there is an interaction relationship between exports, imports, inflation, exchange rates and foreign exchange reserves

with Indonesia's external debt. Given the complexity of the relationship between Indonesia's external debt and the variables of exports, imports, inflation, exchange rates, and foreign exchange reserves, regional and international cooperation is also important. The government can establish partnerships with other countries to increase trade, manage financial risks, and strengthen mutually supportive policy frameworks.
Keywords: Causality, External Debt, Vector Autoregression

A. Introduction

Indonesia, as a developing country, strives to develop the nation and state independently and tries not to depend on the assistance of other countries (Vido Metti Sitepu, 2021). The development of development in line with the rapid global progress that requires every country to be able to keep up with every development that occurs despite being a developing country, requires Indonesia to keep up with current developments (Philippe Duclos et al., 2009). Indonesia tries this by establishing more cooperative relationships with other countries to support development that still has to be developed, especially in terms of the economy with the aim of reducing the impact of Indonesia's dependence on other countries.

Dependency theory suggests that the economic life of a country is influenced by the development and expansion of the economic life of other countries (Helma Malini et.al). Dependency theory focuses on the role of countries as suppliers of raw materials, cheap labor, and markets for expensive industrial goods (Ghosh, 2019). Industrial development in certain countries (underdeveloped or developing) always faces oscillations that lead to a deficit position as a result of dependence (Muhammad Mustapha Abdullahi, 2015). Therefore, developing countries have ways to reduce the impact of dependency, but they need developed countries to increase their economic growth and wealth.

Debt is one way to shape the relationship between developing and developed countries. However, many countries fall into the trap of external debt. External debt will cause problems with budget deficits every year, of course, which will have a direct impact on increasing the amount of external debt. However, if there is a budget surplus, the government can pay off

foreign debt so that the amount decreases (Sebastian Edwards and Leonidas Montes, 2020).

Developing countries like Indonesia have to spend a lot of money to develop (Ravindran Ramasamy and Soroush Karimi Abar, 2015). Efforts to achieve national welfare development sometimes face obstacles. The government's problem is the lack of funds to fund development. Budget deficits result from a mismatch between expenditure and revenue (Liangliang Liu and Wenqing Zhang, 2022). In an effort to correct the imbalance, the Government of Indonesia has started a number of initiatives, including stimulus to optimize sources of state revenue through tax and non-tax extensification and intensification, to the implementation of foreign debt policies.

The amount of Indonesia's foreign debt is certainly a burden to repay in the future. Countries that want to create foreign debt must calculate their financial capacity before deciding to accept foreign debt. This financial capacity is very important to ensure that the government can collapse if they do not pay the debt. Usually, the financial capability should be greater than the external debt. For Indonesia, in the 1945 Constitution, debt is a maximum of 87% of gross domestic product (GDP). In 2018, the debt-to-GDP ratio in Indonesia was around 32%. External debt is part of the total domestic debt from creditors in other countries.

Based on Bank Indonesia (BI) data, the amount of Indonesia's foreign debt continues to increase every year, in 2016 it increased by 9.2 percent, amounting to USD320,006 million compared to the previous year, namely in 2015 amounting to USD310,730 million, in 2017 it increased again by 32.4 percent, then in 2018 it increased by 22.9 percent and in 2019 it increased by 28.1 percent until in 2020 it increased by 13.3 percent, amounting to USD416. 935 million. 935 million. One of the triggers for the increase in foreign debt in 2020 was due to the impact of the Corona Virus Disease 2019 (COVID-19) which caused an economic crisis in 2020, although in 2021 and 2022 the amount of Indonesia's foreign debt

decreased from the previous year by 1.2 percent, amounting to USD396,358 million.

External debt is a variable that can both drive the economy and hinder economic growth. The formal aspect defines foreign debt as a receipt or gift that can be used to increase investment to support economic growth. So based on the functional aspect, foreign loans are one of the alternative sources of financing needed in development (Mukul G. Asher, 2015).

Based on data from the Central Statistics Agency, the development of Indonesia's exports and imports from 2015 to 2022 has fluctuated. Although the proportion of Indonesia's exports is greater than its imports, the large proportion of imports encourages Indonesia to take on foreign debt. This is because the trade balance is still in deficit, so Indonesia needs to improve the quality of its exports and imports. The lower the value of exports and the higher the value of imports by a country will have an impact on increasing the burden of foreign debt so that it can weaken the country's capacity to repay its foreign debt in the long term. So if exports fall then foreign debt increases, conversely if imports increase then foreign debt also increases.

The theoretical framework can explain the discussion of foreign loans that the deficit in private investment financing occurs because savings are smaller than investment (I - S = resource gap), and the trade deficit is caused by exports being smaller than imports (X - M = trade gap). There is still an investment deficit in the government budget because government revenue from taxes is smaller than government expenditure (T - G = fiscal gap).

Based on data from the Central Statistics Agency, the development of inflation in Indonesia from 2015 to 2022 has fluctuated. The inflation rate in 2015 was 3.3 percent and in 2016 it fell to 3.0 percent, then in 2017 it rose slightly to 3.6 percent then continued to decline from 2018, 2019, 2020 to 2022, namely to 3.1 percent, 2.7 percent, 1.6 percent, 1.8 percent and 3.36 percent. So, the high inflation rate causes an increase in foreign debt.

Because Indonesia will tend to import rather than export, because the price offered in the country is more expensive than the price abroad.

Although foreign debt is very helpful for economic growth, it can eventually backfire on Indonesia because it leaves the problem of very high interest rates. In the payment of foreign debt, the government takes a portion of the state budget, while our country still has to finance various other economic sectors that are very high and urgent. The payment of principal installments of foreign debt and interest is a burden that must be carried out continuously considering the exchange rate of the rupiah against the dollar which tends to be unstable every day, even every year. This is because unbalanced exchange rates between industrialized and developing countries hamper economic growth.

Based on Bank Indonesia data, the rupiah exchange rate against the USD in 2015 amounted to IDR 13,795 per USD, and in 2016 amounted to IDR 13,436 per USD or strengthened by 0.3 percent compared to 2015. Then in 2017 it weakened again by 0.1 percent, and in 2018 it continued to weaken by 0.9 percent until in 2019 it strengthened by 0.5 percent. The weakening of the exchange rate was initiated by the trade war between the United States and China and exacerbated by the crisis that occurred in Argentina, then until 2020-2021 the rupiah exchange rate against the USD weakened again to touch 0.1 percent in 2022 it also weakened again by 0.03 percent.

The rupiah exchange rate from 2015 to 2022 fluctuates with a trend that tends to continue to increase. This illustrates that the rupiah exchange rate continues to experience depression in the same period as the increase in foreign debt. One of the important factors affecting the exchange rate is the amount of debt and its composition. The depreciation of the rupiah against the USD will also cause changes in the nominal value of external debt. At maturity, the external debt that Indonesia must pay will follow the exchange rate of the rupiah against foreign currencies that are usually paid in USD.

Theoretically, the relationship between external debt and exchange rate depreciation is positive. There are various arguments against the conclusion that external debt is the main factor causing significant exchange rate depreciation in developing countries (Babatunde Bunmi Osifalujo et al., 2022). However, a sect of the literature fully agrees that large external debt contributes greatly to exchange rate adjustment in developing countries.

Based on data from the Central Statistics Agency, foreign exchange reserves in Indonesia in 2015 amounted to USD105.931 billion, then in 2016 it increased by 10.4 percent and in 2017 it increased by 13.8 percent, but in 2018 it decreased by 9.5 percent compared to the previous year, then in 2019 it increased again by 8.5 percent until 2020 and 2021 it increased by 6.7 percent and 9 percent. In Bank Indonesia's records, the position of Indonesia's foreign exchange reserves at the end of December 2021 remained high at USD144.905 billion, although it decreased compared to the position at the end of December 2022 of USD137.2 billion. The decline in the position of foreign exchange reserves in December 2022 was influenced, among others, by the need to pay government external debt. In recent years, Indonesia's foreign exchange reserves on a scale The more currency or foreign exchange owned by the government and residents of a country, the greater the payment of foreign debt and exchange rate stability (Deliarnov, 2016). However, foreign exchange reserves are not the more the better.

The country's foreign exchange reserves used to pay off foreign debt will be depleted. This will have an impact on the country's low ability to repay foreign debt in a timely manner, thus increasing the burden of foreign debt in the long run.

B. Theoretical Review

1. Economic Development Theory

The terms economic development and development economics are considered to have the same meaning. Economic development is the process of increasing aggregate income and per capita income, given population growth, accompanied by fundamental changes in the economic

structure of the country and in the income distribution of the country's population. Economic development is dependent on economic growth, where economic development contributes to economic growth and vice versa, the economy contributes to the process of economic development. Meanwhile, the goal of economic growth is the process of increasing the production capacity of the economy, which is realized in the form of increased national income. A country can be said to have experienced an increase in economic growth if the country has an increase in Real Gross Domestic Product (Real GDP). The existence of economic growth is one indicator of the success of economic development (Zulfikri Sukarno Patta Rapanna, 2017).

The indicators of economic development are needed as benchmarks in assessing the level of success of the development of a country or society. These indicators must be adjusted to the meaning implied in the definition and concept of development applied. There are two types of indicators, namely economic indicators and non-economic indicators. Economic indicators include Gross National Product (GNP) or Gross Domestic Product (GDP) per capita adjusted for economic growth rate and Gross Domestic Product (GDP) per capita adjusted for Purchasing Power Pharity (PPP) (Sulfi Purnamasari, 2019). Non-economic indicators consist of the Physical Quality of Life Index (PQLI) and the Human Development Index (HDI). These two indicators are also called monetary indicators and non-monetary indicators (Tony S Chendrawan, 2017).

2. Dependency Theory

Dependency Theory is a theory in social science that studies the relationship between developed countries (core countries) and developing countries (peripheral countries) in the context of the global economy. It emerged in the 1950s and 1960s as a response to the economic inequality between resource-rich countries (developed countries) and underdeveloped countries (developing countries). Dependency Theory highlights how the economic relationship between these countries can affect their economic development and growth (William G. Moseley, 2017).

This theory argues that there is an imbalance in economic relations between developed and developing countries. Developed countries, which have resource wealth and technology, tend to monopolize and control global markets, while developing countries are more dependent on developed countries for investment, technology, and export markets. Dependency Theory argues that economic relations between developed and developing countries are often exploitative. Developed countries can exploit developing countries through foreign investments that benefit foreign investors and exports of products that benefit developed countries, while developing countries tend to experience dependence and economic backwardness.

3. Linear Growth Theory

Adam Smith argued that the process of economic growth will occur simultaneously and will be interrelated with one another. Increased productivity in one sector will trigger increased capital formation, encourage new inventions and technological advances, increase work specialization, and will expand the market. All of these economic growth relationships will eventually weaken or stop with the "constraint function" of a lack of economic resources. This is what many underdeveloped countries experience. All stages of development proposed by Adam Smith have one absolute requirement, namely the absolute existence of a perfectly competitive market. The characteristics of a perfectly competitive market include many sellers and buyers in the market. The products offered are homogeneous. There is no collusion between fellow sellers and buyers. Resource mobility is perfect. Perfect information must be obtained for sellers and buyers (Kuncoro, 2010).

4. Structural Change Theory

The theory of structural change this time is a theory that focuses more on all forms of transitions and revolutions that occur in every economic sector. The revolution in question starts from changes in people's behavior, production methods, and institutional structures in a country, especially NSB (Developing Countries). In this theory, countries are grouped based on the process of structural change experienced and the growth of per capita

income levels of their population. In theory, when there is an increase in people's income level, it will be followed by an increase in consumer demand, an increase in capital accumulation, and the development of the industrial sector.

5. External Debt

External debt is defined as the debt owed by residents who are domiciled in an economic theory area to non-residents. External debt can be defined based on various aspects. Based on the material aspect, foreign loans are capital inflows from abroad into the country that can be used as a capital enhancer in the country. Based on the formal aspect, foreign loans are receipts or gifts that can be used to increase investment to support economic growth. Meanwhile, based on its functional aspect, foreign loans are an alternative source of financing needed in development (Abdul Malik, 2017).

6. Export

Export is the sale of goods abroad using a payment system, quality, quantity and other terms of sale that have been agreed upon by the exporter and importer. The export process in general is the act of removing goods or commodities from the country to enter it into another country. In general, the export trade of goods generally requires the intervention of customs in the sending and receiving countries. Exports are an important part of international trade, the influence of exports on international trade and the economic development of a country is very large (Ribka Br Silitonga, 2019).

7. Import

Import can be defined as the purchase of goods and services from abroad into the country with a Cooperation agreement between two or more countries. Import can also be interpreted as trade by entering goods from abroad into Indonesian territory by fulfilling the applicable provisions (Agung Feryanto, 2018).

8. Inflation

Inflation is simply defined as a general and continuous rise in prices over a period of time. An increase in the price of one or two goods alone

cannot be called inflation unless that increase extends (or results in price increases) to other goods, the opposite of inflation is called deflation. Inflation is a condition when the prices of goods/services in general experience a continuous increase so that it can reduce the value of currency in the local country. Based on the explanation above, it can be concluded that inflation can be interpreted as an increase in the prices of goods/services in general and continuously within a certain period of time (Darwis Harahap, 2020).

9. Exchange Rate and Foreign exchange reserve

The exchange rate is the amount of local currency needed to buy one unit of foreign currency. An exchange rate is an exchange between two different currencies, which is a comparison of the value or price between the two currencies. The exchange rate is the value or price of a country measured in another country's currency. For example, the rupiah exchange rate against the Singapore dollar, the rupiah exchange rate against the Pakistani rupee, the rupiah exchange rate against the Malaysian ringgit and so on (Hijri Juliansyah et al., 2020).

Foreign exchange reserves are a very important monetary indicator that shows the strength or weakness of a country's economic fundamentals. The small amount of foreign exchange reserves causes a country to be unable to make international payments and exchange rate stability, resulting in a deficit in the balance of payments and a fall in the exchange rate, making the country weak in international trade (Agustina and Reny, 2014).

C. Research Method

This research was conducted using quantitative research methods. Quantitative research is research that works with numbers, whose numbers are in the form of numbers that are analyzed using statistics to answer specific research questions or hypotheses, and to make predictions about other variables. The type of data used in this research is secondary data. *Secondary* data is a source of research data obtained by researchers indirectly through intermediary media. The data taken by researchers comes from www.bi.go.id and www.bps.go.id. In this study there are 6

variables, namely Exports, Imports, Inflation, Exchange Rate / Exchange Rate, Foreign Exchange Reserves and Foreign Debt.

The population in this study is data on foreign debt, exports, imports, inflation, exchange rates / rates, and foreign exchange reserves that have been published by Bank Indonesia from 2012-2022, namely 132 months. The sampling technique used is *purposive sampling* with the number of samples to be taken based on an assessment of the characteristics of sample members in accordance with the year which is the problem in this study. By considering the characteristics of this research sample, researchers are expected to collect relevant and representative data to test the causal relationship between Indonesia's foreign debt and other economic variables using the *Vector Autoregression* (VAR) approach. Therefore, there are 96 research samples from 2015 to 2022. Data analysis techniques used are stationarity test, stability test, optimal lag determination, Granger Causality Test, Cointegration Test, VAR model estimation, *Impulse Response Functions, and Forcast Error Variance Decompocitions.*

D. Result and Discussion

1. Stationarity test

The following are the results of the stationarity test using Augmented Dickey Fuller (ADF) in this study:

Tabel IV.1. Stasionerity Test

Variabel	*Level*		*First Difference*	
	ADF	Prob	ADF	Prob
External Debt	**1,69**	**0,43**	**10,69**	**0,00**
Export	**0,73**	**0,83**	**10,27**	**0,00**
Import	**0,84**	**0,80**	**13,32**	**0,00**
Inflation	**1,63**	**0,46**	**9,08**	**0,00**
Exchange Rate	**2,64**	**0,08**	**10,96**	**0,00**
Foreign Exchange Reserves	**1,12**	**0,71**	**10,03**	**0,00**

The stationarity test results show that the variables of Indonesia's external debt, exports, imports, inflation, exchange rates and foreign

exchange reserves are not stationary at the level. However, after testing stationary data at the *first difference* level, the variables of Indonesia's external debt, exports, imports, inflation, exchange rates and foreign exchange reserves have been stationary because the ADF significance has a probability value of each variable smaller than 5%.

2. Stability Test

After all variables are stationary, the next step is the stability test. In the stability stage, the maximum interval length of the stable VAR system will be seen. The following are the results of the stability test in this study.

Tabel IV.2. Stability Test

Root	Modulus
-0.341638 - 0.486235i	0.594257
-0.341638 + 0.486235i	0.594257
-0.172630 - 0.549398i	0.575881
-0.172630 + 0.549398i	0.575881
-0.572806	0.572806
0.347522 - 0.300323i	0.459309
0.347522 + 0.300323i	0.459309
-0.025413 - 0.415664i	0.416440
-0.025413 + 0.415664i	0.416440
-0.298737 - 0.250452i	0.389833
-0.298737 + 0.250452i	0.389833
0.046377	0.046377

Based on the test results, it can be concluded that all roots have a modulus smaller than one (Modulus < 1) and all are located inside the unit *circle*. Therefore, the data is stable.

3. Optimal *Lag* Determination

After the research data is stable, the next step is to determine the optimal lag length of this research. This aims to determine the optimum number of lags. This optimum lag test is very useful for eliminating autocorrelation problems in the VAR system. so that by using the optimum lag it is hoped that the autocorrelation problem will no longer arise. The following are the results of determining the optimal lag of this study:

Tabel IV.3. Optimal Lag Determination

Lag	LogL	LR	FPE	AIC	SC	HQ
0	896.4848	NA	1.03e-16	-19.78855	-19.62190*	-19.72135*
1	942.6979	85.23747	8.19e-17	-20.01551	-18.84893	-19.54508
2	981.8160	66.93543*	7.72e-17*	-20.08480*	-17.91830	-19.21114
3	1012.891	49.02960	8.85e-17	-19.97536	-16.80893	-18.69847
4	1036.919	34.70733	1.21e-16	-19.70932	-15.54297	-18.02920
5	1070.402	43.89927	1.40e-16	-19.65337	-14.48710	-17.57003

Determination of the optimal *lag* results obtained by the selected hose candidate based on the shortest *lag* according to the *Likelihood Ratio* (LR), *Final Prediction Error* (FPE), and *Akaike Information Criterion* (AIC) criteria, which is optimal at *lag* 2.

4. Granger Causality Test

After obtaining the optimal *lag* size, this study conducted a Granger causality test which shows whether there is a causal relationship between the five variables studied and what is the direction of the relationship.

Tabel IV.4. Granger Causalitiy Test

Null Hypothesis:	Obs	F-Statistic	Prob.
EKS does not Granger Cause ULN	94	2.17567	0.1195
ULN does not Granger Cause EKS		0.87053	0.4223
IMP does not Granger Cause ULN	94	1.89245	0.1567
ULN does not Granger Cause IMP		0.35107	0.7049
INF does not Granger Cause ULN	94	0.46402	0.6303
ULN does not Granger Cause INF		1.54753	0.2184
KURS does not Granger Cause ULN	94	0.13840	0.8709
ULN does not Granger Cause KURS		0.75346	0.4737
CD does not Granger Cause ULN	94	0.77633	0.4632
ULN does not Granger Cause CD		2.36140	0.1002

Based on the results of conducting the Granger causality test, there are five two-way relationships between research variables that can be concluded as follows:

a. The Granger test with the export variable shows that there is no one-way causality relationship, that is, exports do not have a one-way relationship with Indonesia's foreign debt. Conversely, the Granger

test with the Indonesian external debt variable shows that there is no one-way causality relationship, namely exports do not have a one-way relationship with Indonesia's external debt. This means that there is no two-way causality relationship between exports and Indonesia's external debt.

b. The Granger test with the import variable shows that there is no one-way causality relationship, imports do not have a one-way relationship with Indonesia's external debt. Conversely, the Granger test with Indonesia's external debt variable shows that there is no one-way causality relationship, that is, imports do not have a one-way relationship with Indonesia's external debt. That is, there is no two-way causality relationship between imports and Indonesia's external debt.
c. Granger test with inflation variable shows that there is no one-way causality relationship, i.e. inflation does not have a one-way relationship with Indonesia's external debt. Conversely, the Granger test with Indonesia's external debt variable shows that there is no one-way causality relationship, namely inflation does not have a one-way relationship with Indonesia's external debt. That is, there is no two-way causality relationship between inflation and Indonesia's external debt.
d. The Granger test with the exchange rate variable shows that there is no one-way causality relationship, that is, the exchange rate does not have a one-way relationship with Indonesia's external debt. Conversely, the Granger test with Indonesia's external debt variable shows that there is no one-way causality relationship, namely the exchange rate does not have a one-way relationship with Indonesia's external debt. That is, there is no two-way causality relationship between the exchange rate and Indonesia's external debt.
e. The Granger test with the foreign exchange reserves variable shows that there is no one-way causality relationship, that is, foreign exchange reserves do not have a one-way relationship with

Indonesia's external debt. Conversely, the Granger test with Indonesia's external debt variable shows that there is no one-way causality relationship, namely foreign exchange reserves do not have a one-way relationship with Indonesia's external debt. This means that there is no two-way causality relationship between foreign exchange reserves and Indonesia's external debt.

5. Cointegration Test

The next step is cointegration testing which is used to see the long-term balance between the observed variables. A data that is individually non-stationary, but when connected linearly the data becomes stationary or often known as cointegrated. The following are the provisions of the cointegration test:

Tabel IV.5. Cointegration Test Result

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.581513	254.8829	95.75366	0.0000
At most 1 *	0.509910	174.7408	69.81889	0.0000
At most 2 *	0.356327	109.1295	47.85613	0.0000
At most 3 *	0.269117	68.59751	29.79707	0.0000
At most 4 *	0.255306	39.75529	15.49471	0.0000
At most 5 *	0.128327	12.63537	3.841465	0.0004

Based on cointegration test, the Significant Probability value of 0.00 < 5%, then it is assumed that cointegration occurs. This indicates that the variables have a long-run equilibrium. Variables have a long-run equilibrium. So further research uses the Error Correction Model (ECM) test.

6. Estimasi Model VECM

The Vector Error Correction Model (VECM) estimation is used to analyze the correlation in the dependent variable due to the imbalance condition of several variables. The following are the results of the research model estimation generated in this study:

Tabel IV.6. VECM Long Run Estimation

Endogen	Eksogen	Koefisien	S.E	T stat
ULN (0,062488)	EKS	-1,569887	0,84873	-1,84969
	IMP	-3,078868	0,73035	-4,21559
	INF	0,842290	0,28419	2,96381
	KURS	-14,162160	2,12589	-6,66177
	CD	-5,461780	2,07780	-2,62863

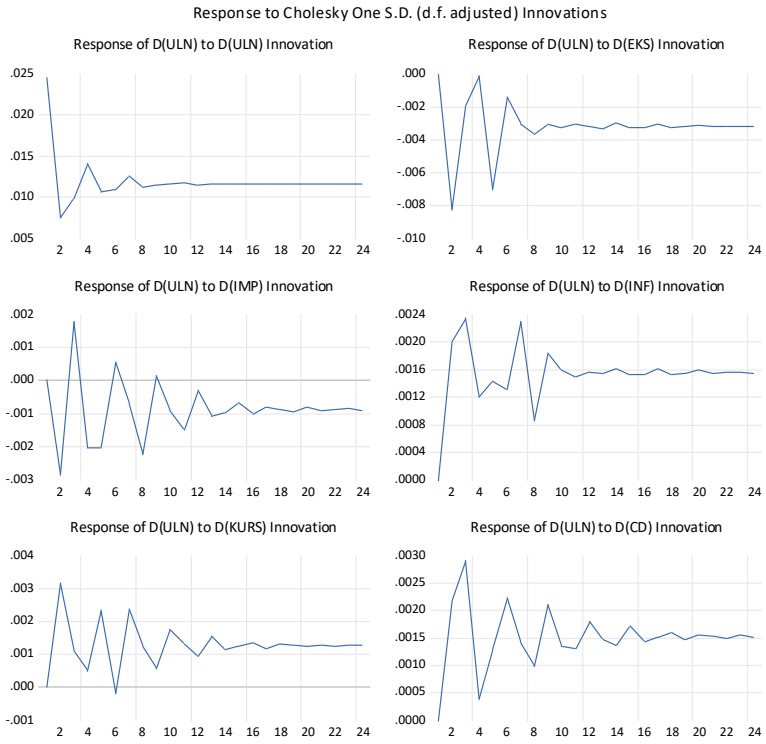
The long-term analysis in the Indonesian foreign debt equation model formed is:

ULN = 0,06 – 1,57 EKS – 3,08 IMP + 0,84 INF – 14,16 KURS – 5,46 CD + e

7. Impuls Respon Functions (IRFs)

IRF (Impulse Response Function) analysis is a tool used in econometric analysis to measure the long-run and short-run impact of changes in certain variables on other variables in an economic model. In the context of this study, if the IRF analysis of Indonesia's external debt with a period of 24 periods, the IRF can be explained as follows:

Figure 1. Impuls Respon Functions (IRFs)



Based on IRF analysis, in the first period of IRF analysis, there is no interaction or direct impact of the variables of exports, imports, inflation,

exchange rates, and foreign exchange reserves on Indonesia's external debt. This shows that in the short term, changes in these variables do not directly affect changes in Indonesia's external debt. other factors or other variables that are not included in the analysis model can affect Indonesia's external debt in that period.

In the second period of IRF analysis, a shock or change in the export and import variables causes a negative response to Indonesia's external debt. This means that an increase in exports and a decrease in imports can reduce Indonesia's external debt in the short term. This can occur due to increased foreign exchange earnings from exports and a reduction in international payment obligations through imports. Also, if high inflation makes the real value of debt decrease, then Indonesia's foreign currency denominated external debt will appear smaller. In addition, a depreciation of the Rupiah exchange rate can increase the burden of external debt in Rupiah, while a decline in foreign exchange reserves indicates the use of reserves to repay external debt.

8. *Variance Decompositions* (VD)

Variance decomposition is a method to understand the relative role of different variables in explaining the variation of Indonesia's external debt equation from period one to period twenty-four. In this context, the variation in Indonesia's external debt equation can be broken down into two components of contribution from Indonesia's external debt itself and contribution from other variables such as exports, imports, inflation, exchange rates, and foreign exchange reserves. The following are the results of the variance decomposition test in this study:

Tabel IV.7. *Variance Decomposition*

Period	S.E.	D(ULN)	D(EKS)	D(IMP)	D(INF)	D(KURS)	D(CD)
1	0.024555	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.027489	87.42793	9.022652	1.073390	0.530021	1.323249	0.622762
3	0.029601	86.62670	8.217425	1.284919	1.086333	1.278070	1.506548
4	0.032907	88.62589	6.650517	1.421000	1.013108	1.057202	1.232285
5	0.035486	85.28168	9.604920	1.551688	1.034336	1.338107	1.189267
6	0.037257	85.99683	8.857984	1.429692	1.063680	1.216258	1.435554
7	0.039623	86.17571	8.425142	1.294573	1.275877	1.431544	1.397154
8	0.041457	86.11596	8.473221	1.471537	1.208449	1.398603	1.332228
9	0.043228	86.30314	8.284980	1.354627	1.290734	1.303168	1.463354
10	0.044985	86.42926	8.165885	1.290661	1.316320	1.355873	1.442003
11	0.046673	86.60741	8.011772	1.299657	1.326121	1.338299	1.416738
12	0.048259	86.74724	7.937080	1.219470	1.344421	1.288624	1.463167
13	0.049825	86.79065	7.894832	1.191700	1.356554	1.306626	1.459641
14	0.051326	86.96508	7.772186	1.159463	1.377502	1.279471	1.446298
15	0.052796	87.03796	7.728980	1.111851	1.384744	1.264599	1.471869
16	0.054218	87.10500	7.685239	1.090122	1.392476	1.261756	1.465402
17	0.055604	87.21457	7.608841	1.058247	1.408212	1.243789	1.466340
18	0.056962	87.26371	7.578918	1.031232	1.413714	1.237436	1.474989
19	0.058280	87.33458	7.532911	1.010553	1.420564	1.229226	1.472163
20	0.059575	87.39968	7.488821	0.985681	1.430506	1.219173	1.476137
21	0.060841	87.44507	7.459402	0.967882	1.435261	1.213929	1.478460
22	0.062079	87.50177	7.422630	0.949415	1.441770	1.205966	1.478448
23	0.063295	87.54658	7.392965	0.931222	1.447818	1.199843	1.481568
24	0.064488	87.58780	7.365788	0.916978	1.452472	1.194762	1.482197

Cholesky One S.D. (d.f. adjusted)
Cholesky ordering: D(ULN) D(EKS) D(IMP) D(INF) D(KURS) D(CD)

The decomposition of Indonesia's external debt equation is that in the first period after a shock to Indonesia's external debt, other variables have not played a significant role in explaining variations in Indonesia's external debt equation. This is because changes in Indonesia's external debt are the dominant factor affecting variations in the equation. Therefore, the contribution of Indonesia's external debt in explaining the variation of Indonesia's external debt in this period is greater than the contribution of other variables.

However, over time, other variables such as exports, imports, inflation, exchange rates, and foreign exchange reserves can begin to play a role in explaining variations in Indonesia's external debt equation. In the twenty-fourth period, after one period of the shock to Indonesia's external debt, these variables can start to make a significant contribution in explaining the variation of Indonesia's external debt.

In the first period, there was a shock that caused a sharp increase in Indonesia's external debt. In this period, the variables of exports, imports,

inflation, exchange rate, and foreign exchange reserves do not make a significant contribution in explaining the variation in Indonesia's external debt. In this case, the main contribution in explaining the variation in Indonesia's external debt comes from the direct change in Indonesia's external debt itself. However, in the twenty-fourth period, after one period of the shock to Indonesia's external debt, the variables of exports, imports, inflation, exchange rates, and foreign exchange reserves can begin to play a role. This means that an increase in exports can contribute to reducing the variation in Indonesia's external debt, as the foreign exchange revenue earned from exports can be used to repay external debt. Similarly, a decrease in imports or a depreciation of the Rupiah exchange rate can have a positive contribution in reducing Indonesia's external debt. Also, an increase in foreign exchange reserves can help reduce the variation in Indonesia's external debt, as foreign exchange reserves can be used to repay external debt.

However, in the second period after the shock, the composition of Indonesia's external debt variance changes and is formed from the contribution of variations in other components such as exports, imports, inflation, exchange rates, and foreign exchange reserves. For example, in the second period, the export component contributed 9.02% to the variation of Indonesia's external debt, the import component amounted to 1.07%, the inflation component amounted to 0.53%, the exchange rate component amounted to 1.31%, and the foreign exchange reserves component amounted to 0.62%.

9. Hypothesis Testing

1) Granger hypothesis test result

a) Granger test with the export variable shows that there is no one-way causality relationship, that is, exports do not have a one-way relationship with Indonesia's foreign debt.

b) Granger test with Indonesia's foreign debt variable shows that there is no one-way causality relationship, namely Indonesia's foreign debt does not have a one-way relationship with exports.

c) Granger test with the import variable shows that there is no one-way causality relationship, that is, imports do not have a one-way relationship with Indonesia's foreign debt.
d) Granger test with Indonesia's foreign debt variable shows that there is no one-way causality relationship, i.e. Indonesia's foreign debt does not have a one-way relationship with imports.
e) Granger test with inflation variable shows that there is no one-way causality relationship, i.e. inflation does not have a one-way relationship with Indonesia's foreign debt.
f) Granger test with Indonesia's foreign debt variable shows that there is no one-way causality relationship, i.e. Indonesia's foreign debt does not have a one-way relationship with inflation.
g) Granger test with the exchange rate variable shows that there is no one-way causality relationship, namely the exchange rate does not have a one-way relationship with Indonesia's foreign debt.
h) Granger test with Indonesia's foreign debt variable shows that there is no one-way causality relationship, namely Indonesia's foreign debt does not have a one-way relationship with the exchange rate.
i) Granger test with the foreign exchange reserves variable shows that there is no one-way causality relationship, namely foreign exchange reserves do not have a one-way relationship with Indonesia's foreign debt.
j) Granger test with Indonesia's foreign debt variable shows that there is no one-way causality relationship, namely Indonesia's foreign debt does not have a one-way relationship with foreign exchange reserves.
k) There is no long-term interaction relationship between exports and Indonesia's external debt.
l) There is a long-run negative interaction relationship of imports on Indonesia's external debt.
m) There is a long-term positive interaction relationship between inflation and Indonesia's external debt.

n) There is a long-term negative interaction relationship between exchange rate and Indonesia's external debt.
o) There is a long-term negative interaction relationship between foreign exchange reserves and Indonesia's external debt.
p) There is a short-term negative interaction relationship between exports and Indonesia's external debt.
q) There is no short-term interaction relationship between imports and Indonesia's external debt.
r) There is no short-term interaction relationship between inflation and Indonesia's external debt.
s) There is a short-term positive interaction relationship between exchange rate and Indonesia's external debt.
t) There is no short-term interaction relationship between foreign exchange reserves and Indonesia's external debt.
u) There is no short-term interaction relationship between Indonesia's foreign debt and exports.
v) There is no short-term interaction relationship between Indonesia's foreign debt and imports.
w) There is no short-term interaction relationship between Indonesia's foreign debt and inflation.
x) There is no short-term interaction relationship between Indonesia's foreign debt and the exchange rate.
y) There is no short-term interaction relationship between Indonesia's foreign debt and foreign exchange reserves.

E. Conclusion

1) The Granger test shows that there is no two-way causality relationship between exports and Indonesia's external debt. This is consistent with the results of long-term research, namely there is no long-term interaction relationship between exports and Indonesia's foreign debt, and there is no long-term interaction relationship between Indonesia's foreign debt and exports. However, in the short term, there is a negative interaction relationship between exports and

Indonesia's foreign debt. However, there is cointegration in the study. IRF analysis shows that in the second period there is a change in the export variable that results in a negative response to Indonesia's external debt. This indicates that an increase in exports has the potential to reduce Indonesia's foreign debt in the short term. Thus, there is an interaction relationship between exports and Indonesia's foreign debt in 2015-2022.

2) The Granger test shows that there is no two-way causality between imports and Indonesia's external debt. However, in the long run, there is a negative interaction relationship between imports and Indonesia's external debt. Meanwhile, in the short term, there is no interaction relationship between imports and Indonesia's external debt. However, there is cointegration in the study. The IRF analysis showed that in the second period, there was a change in the import variable that resulted in a negative response to Indonesia's external debt. This indicates that a decrease in imports has the potential to reduce Indonesia's external debt in the short term. Hence, a reduction in imports can reduce international payment obligations. Thus, there is an interaction relationship between imports and Indonesia's external debt in 2015-2022.
3) The Granger test shows that there is no two-way causality between inflation and Indonesia's external debt. However, in the long run, there is a positive interaction relationship between inflation and Indonesia's external debt. While in the short term, there is no short-term interaction relationship between inflation and Indonesia's external debt. However, there is cointegration in the study. The IRF analysis shows that in the second period there was a change in the inflation variable which resulted in a positive response to Indonesia's external debt. This indicates that an increase in high inflation increases the burden of foreign debt in domestic currency. So there is an interaction relationship between inflation and Indonesia's foreign debt in 2015-2022.

4) Granger test there is no two-way causality relationship between the exchange rate and Indonesia's external debt. However, in the long run, the results show that there is a negative interaction relationship between the exchange rate and Indonesia's foreign debt. While in the short term, there is a short-term positive interaction relationship of the exchange rate on Indonesia's foreign debt. Even so, cointegration occurs in the study. IRF analysis shows that in the second period there is a change in the exchange rate variable that results in a positive response to Indonesia's external debt. In terms of the real value of debt decreases, so Indonesia's foreign currency denominated external debt looks smaller. However, the depreciation of the Rupiah exchange rate can increase the burden of foreign debt in domestic currency. So there is an interaction relationship between the exchange rate and Indonesia's foreign debt in 2015-2022.
5) The Granger test shows that there is no two-way causality relationship between foreign exchange reserves and Indonesia's external debt. However, in the long term, there is a negative interaction relationship between foreign exchange reserves and Indonesia's external debt. Meanwhile, in the short term, there is no interaction relationship between foreign exchange reserves and Indonesia's external debt. However, there is cointegration in the study. The IRF analysis shows that in the second period there is a change in the foreign exchange reserves variable which results in a positive response to Indonesia's external debt. This indicates that there is an involvement of foreign exchange reserves in reducing foreign debt. So there is an interaction relationship between foreign exchange reserves and Indonesia's foreign debt in 2015-2022.

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