The Realitionship Between GDP, Exchange Rate, Export And Import In Indonesia: A VECM Model Approach

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Abstract

The study is designed to explore the influence of international trade, particularly exports, on Indonesia's economy. It utilizes time series data spanning from 1991 to 2022 to examine the interconnections among crucial economic indicators like exports, GDP, imports, and exchange rates through VECM analysis. The findings reveal statistically significant causal relationships between exports and other key variables, including imports and GDP. This sheds light on the significance of exports in shaping the economic landscape of Indonesia and informs the development of trade policies and economic growth strategies.

Introduction

Indonesia's economy, which is constantly growing, presents both opportunities and challenges in global trade. The circumstances surrounding Indonesia's foreign trade in 2022 displayed intriguing characteristics. The GDP has grown significantly, there have been deliberate swings in exchange rates, and the number of imports and exports has increased. A post-pandemic economic rebound is indicated by the expanding GDP, and the intricate interplay between domestic monetary policy and international market conditions is reflected in the volatile exchange rate. While the expansion in imports suggests a strong internal demand for technology and raw resources, the increase in exports shows how competitive Indonesian products are in the global market.

A number of events that occurred in 2022 gave the Indonesian economy a complex picture of the dynamics of economic growth, global commerce, and exchange rate stability (Anas et al., 2022). The primary focus of analysis for Indonesia's economic performance in that year shifted to statistical data. Following a period of contraction brought on by the COVID-19 epidemic, Indonesia's GDP growth in 2022 showed clear signs of recovery (Antara & Sumarniasih, 2022). The Central Statistics Agency (BPS) reported that Indonesia's GDP increased by almost 5.5% in that year. Manufacturing, agriculture, and services were the primary growth-promoting sectors. Robust expansion in these domains was indicative of the efficacious endeavors undertaken by the administration to revive the economy.

Indonesia's exports saw a notable increase in the realm of international trade. The value of Indonesia's exports in 2022 was estimated by the Ministry of Trade to be over 180 billion US dollars, a 15% rise from the year before. The bulk of Indonesia's exports were now made up of manufactured items, including electronics, automobiles, and textiles. Nonetheless, there was a notable increase in imports as well, which was indicative of the strong demand for machinery and industrial raw materials. According to data, Indonesia's import value increased by almost 20% from the previous year to over 200 billion US dollars in 2022. Due to the significant

increase in imports, there is a trade deficit that must be properly handled in order to keep the nation's balance of payments stable (Panshak, Civcir, & Ozdeser, 2019).

The Indonesian rupiah fluctuated significantly in regard to the exchange rate compared to other foreign currencies and the US dollar. The average rate of exchange between the rupiah and the US dollar in 2022 was approximately 14,000 rupiah per US dollar, according to data from Bank Indonesia. The direction of currency rate changes is mostly determined by factors including investor mood, global market circumstances, and monetary policy. People's purchasing power, import expenses, and export sector performance are all significantly impacted by these exchange rate swings (Ilmas, Amelia & Risandi, 2022).

The Indonesian government is still working to preserve economic stability and foster an atmosphere that supports sustainable growth in the face of these diverse economic dynamics (Laurens & Putra, 2020). The objective of Indonesia's economic reform prioritizes economic policies that center on growing leading sectors, enhancing industrial competitiveness, and reducing trade imbalances. The government makes an effort to make the best choices possible in light of the opportunities and challenges presented by the dynamics of the global economy by employing the statistical data that is readily available.

The four factors are crucial predictors of a nation's economic health and ability to compete in global trade. Strong exchange rates, a high percentage of exports compared to imports, and rapid economic development are all indicators of a vigorous economy (Mania & Rieber, 2019). It's interesting that there seems to be some ambiguity about the relationship between these four factors. Thus, the purpose of this study is to use statistics on exports, imports, exchange rates, and GDP to further assess how international commerce affects the nation's economy. It is yet unclear how these four variables relate to one another, though. The data variables of GDP, imports, exports, and exchange rates will be used in this study to determine the relationship between a nation's economic growth and international commerce over a considerable time span, from 1991 to 2022. Therefore, fresh perspectives and a more profound comprehension of the dynamics of the global economy are anticipated from this research.

Literature Review

Exports

In fact, exports are crucial to the Indonesian economy. Exports, a significant source of foreign exchange, support exchange rate stability and the balance of payments. Furthermore, exports are a major factor in the expansion of the economy as a whole. According to the export-led growth (ELG) theory, exports have the capacity to be a major factor in a nation's economic expansion. This hypothesis holds that exports can boost production efficiency, make use of current capacity, and stimulate innovation in linked industries. Put another way, by promoting greater output, labor absorption, and capital accumulation, exports can initiate a positive feedback loop of economic expansion. Wilson et al.'s research from 2022 revealed a positive correlation between exports and economic development from 1986 to 2021. This result adds credence to the theory that exports are a major driver of economic growth in Indonesia.

Economic Growth

One of the main elements that has a big impact on a nation's export performance is economic growth. Economic theory has long emphasised that nations experiencing rapid economic expansion typically possess greater production capacity, hence potentially augmenting both the quantity and worth of their exports. Stable and durable economic growth has been a key factor in

Indonesia's increased exports. The Gross Domestic Product (GDP), which represents the entire value of goods and services generated in a nation during a specific time period, is frequently used to measure economic growth (Coscieme et al., 2020). Production and national income typically rise in tandem with economic expansion. A nation's production capacity can rise with robust economic growth, enabling the manufacture and export of more goods and services.

In Indonesia's case, export development has been aided by steady and sustainable economic growth in a number of ways. Robust economic expansion fosters a more favorable business environment and instills confidence in company players to boost output and exports. Furthermore, domestic purchasing power can rise with sustainable economic growth, stimulating both domestic demand and exports (Arslan et al., 2022). Therefore, efforts to enhance a nation's export performance depend heavily on maintaining steady and sustainable economic growth. In order to boost economic growth and Indonesia's overall export performance, appropriate economic policies, investments in infrastructure, education, and innovation, as well as active trade promotion, can all be useful tactics.

Exchange Rate

The exchange rate is a major factor in determining a nation's export performance in addition to economic growth. The competitiveness of export items in the global market is significantly impacted by the changes of the exchange rate (Yanita, Napitupulu & Rahmah, 2019). Export prices decrease in foreign currency when the home currency appreciates, making export goods more competitive. Stated differently, currency depreciation can lead to a decrease in the cost of export goods for customers abroad, hence increasing the volume and value of exports. High fluctuations in exchange rates, however, might also make business participants uncertain, such as importers and exporters (Al-Thaqeb, Algharabali, & Alabdulghafour, 2022). Unpredictable variations in exchange rates can cause disruptions to corporate planning, increasing risk and necessitating additional expenditures for risk mitigation. This may weaken the export market's stability and confidence, which may eventually have an impact on export volume.

As a result, it is crucial that the government and corporate players keep an eye on and prudently control the currency rate. A more favourable climate for exports can be achieved by implementing the right measures to preserve exchange rate stability and lessen its volatility. Effective risk management techniques are also required to shield corporate actors from erratic changes in currency rates, allowing them to conduct their export operations with greater stability and effectiveness. As a result, the exchange rate needs to be carefully considered when developing economic policies and corporate plans in addition to being a significant influence in determining a nation's export performance.

Imports

One theory that explains the relationship between imports and exports is the Comparative Advantage Theory put out by David Ricardo (Murdock, 2020). This theory states that if there are differences in each country's comparative advantage, then exports or commerce can take place internationally. A nation can obtain this comparative advantage if it can create a lot of items at a cheaper cost than other nations. For instance, Indonesia enjoys a comparative advantage over Malaysia in the production of coffee if both countries produce tin and coffee, and if Indonesia can produce coffee more cheaply than Malaysia but cannot manufacture tin as effectively. Malaysia, on the other hand, has a comparative edge in the production of tin. In this scenario, efficient imports and exports between the two nations are possible if they trade these goods, with Indonesia sending coffee to Malaysia and Malaysia sending tin to Indonesia.

This idea is significant because it demonstrates that imports are not just about purchasing things from overseas; they can also have an impact on exports by changing the structure of domestic production (Murdock, 2020). Exporting more cost-effectively produced items and importing goods that are substantially more expensive to manufacture domestically are the tendencies of nations. The author can examine the long-term link between imports and exports by utilizing the VECM analysis approach, which takes into account additional variables like GDP and exchange rate that also impact the dynamics of international trade.

Previous Research
Because they significantly increase the Gross Domestic Product, exports are essential to a nation's economic growth (Sultanuzzaman et al., 2019). A nation can raise money by selling goods and services to outside markets through exports, which boosts the nation's total economic output. This boosts the nation's competitiveness abroad, generates employment, and promotes investment in industry and infrastructure.

In the framework of global trade, exports significantly boost imports (Salman et al., 2019). A nation's ability to decrease its reliance on imports is frequently facilitated by a trade surplus that arises from successful export growth. Increased exports allow the nation to make more money from the selling of goods and services to outside markets, which may then be utilized to reduce imports of goods and services.

A nation's currency exchange rate is significantly positively impacted by its exports (Singhal, Choudhary & Biswal, 2019). A nation's currency tends to be in higher demand when it increases its export volume, which can support the nation's exchange rate. When imported items become more affordable in domestic currency denominations, an increase in the exchange rate can lead to a decrease in the cost of imports.

Exports significantly improve their own situation (Daengs et al., 2020). A nation's ability to expand its export volume not only contributes to economic growth by generating more revenue from the sale of products and services to foreign markets, but it also sets off a chain reaction that fortifies the export industry as a whole. A rise in exports leads to higher output across the board in the industries that make up the export supply chain, which boosts employment, fosters innovation, and makes homegrown goods more competitive.

There are circumstances in which exports can significantly harm a nation's GDP (Thuy & Thuy, 2019). An instance of this would be if the nation's economic growth is primarily predicated on its exports. Export revenue may decline if there is a decline in the demand for the goods and services that nation exports, for whatever reason—a recession in the nations with which it trades or shifts in consumer preferences worldwide, for instance.

In the framework of international trade, exports can significantly harm imports (Feenstra, Ma, & Xu, 2019). A decline in a nation's export volume may result in a decline in the money it makes from foreign commerce. This decline is probably going to make it harder for the nation to purchase goods and services from other nations, which may cause imports to decline.

A nation's currency exchange rate can be significantly impacted negatively by exports (Lies Maria Hamzah, 2021). A country's currency may see a decline in demand on the global market if its export volume declines. Because of a greater supply than demand, the currency's exchange rate therefore tends to drop. A decline in the value of the currency exchange rate may have negative effects on the economy.

The export sector as a whole may suffer greatly from large declines in shipments (Iacovone et al., 2019). A country's ability to earn from international trade is diminished when its export

volume declines, and this can have a cascading impact that harms multiple facets of the export industry. A decline in exports lowers the demand for export goods, which in turn lowers production across a number of linked industries and may even lead to a decline in employment.

A nation's Gross Domestic Product (GDP) is significantly boosted by imports (Okyere & Jilu, 2020). Because they involve purchasing goods and services from other nations, imports are sometimes viewed as a negative expense; nonetheless, in the current global economic setting, imports are essential for improving economic efficiency and diversifying the product line. A nation can satisfy its domestic demands at a lesser cost or with greater quality by importing commodities that are not produced domestically or that have lower manufacturing costs in other nations.

In the framework of global trade, imports significantly benefit themselves (Wen et al., 2021). Imports are sometimes viewed as a waste of money since they require the purchase of goods and services from elsewhere, but in reality, they are crucial for boosting domestic economic activity and diversifying the product line. A nation can increase domestic consumer and industry choices by importing items that are either more affordable or of greater quality from other countries, particularly if such commodities are manufactured elsewhere or have lower manufacturing costs.

A nation's currency exchange rate can benefit greatly from imports (Auer, Burstein & Lein, 2021). Importing products and services from overseas raises a nation's currency's demand on the global market. The currency exchange rate usually strengthens in response to an increase in demand for the currency. One of the many economic advantages of a stronger currency exchange rate is that it can lower the cost of imported items for domestic consumers, boosting their purchasing power.

A nation's export volume can be significantly increased by imports (Br Purba & Rahmadana, 2021). While imports are sometimes viewed as a bad investment because they entail buying products and services from elsewhere, they can actually be quite beneficial in strengthening a nation's export potential. A nation can increase the productivity and caliber of its output by importing the raw materials, parts, or completed commodities required to produce export goods.

In some circumstances, imports can significantly harm a nation's GDP (Gross Domestic Product) (Stievany & Jalunggono, 2022). While imports are required to promote economic activity and meet domestic demands, an excessive reliance on imports can lead to issues. A trade deficit can strain an economy if a nation imports more products and services than it exports.

The import sector as a whole may suffer greatly from a large decline in imports (Bachmann et al., 2022). A reduction in a nation's import volume can be a sign of a wider downturn in economic activity as well as a decrease in servicing domestic demands. A fall in imports may result in a decline in the demand for foreign products and services, upsetting the world supply chain and impeding cross-border trade.

A country's currency exchange rate may suffer significantly from a large decline in imports (Ha, Stocker & Yilmazkuday, 2020). The demand for that nation's currency on the global market often declines as import volume does. The currency exchange rate may weaken as a result of an excess supply of local currency compared to the demand for it. A decline in the value of the currency exchange rate can have a number of negative effects on the economy, one of which is raising the cost of imported goods for domestic customers.

A nation's export industry may suffer greatly from a large drop in import volume (Handley, Kamal & Monarch, 2020). A sharp decline in imports may indicate a number of issues influencing global trade, including a decline in people's purchasing power or a decline in the demand for particular goods throughout the world. Reduced demand for a nation's exported

goods and services may result from a decline in imports, which may impede the expansion of the export industry.

GDP (gross domestic product) positively impacts itself to a great extent (Newell, Prest, & Sexton, 2021). GDP growth is a key indicator of a nation's economic health and a direct driver of increased citizen welfare. An increase in the total production of goods and services over a given time period is reflected in a country's GDP. GDP growth can boost consumer purchasing power, raise income levels, and promote the development of jobs.

A country's imports are significantly positively impacted by a rise in Gross Domestic Product (GDP) (Ramzan et al., 2019). A rising GDP typically indicates robust economic expansion and rising purchasing power of the populace. In the context of global trade, rising GDP growth is frequently accompanied by rising import demand since more people have more money to spend on imported items.

A country's currency exchange rate is significantly positively impacted by an increase in Gross Domestic Product (GDP) (Morina et al., 2020). A rising GDP indicates robust economic conditions and heightened investor confidence in a nation. A rising GDP may be a sign of steady economic expansion, which in turn may pique the interest of foreign investors in that nation.

A country's export volume is positively impacted by a rise in Gross Domestic Product (GDP) (Ramzan et al., 2019). An increase in a nation's GDP typically indicates rapid economic expansion and rising population purchasing power. Economic expansion has the potential to increase demand for products and services exported by a nation in the context of international trade.

GDP growth is typically regarded as a desirable objective in economic policy since it serves as a key gauge of a nation's economic health. GDP growth is an indicator of sound economic expansion, which is frequently accompanied by rising incomes, employment rates, and population purchasing power. It is hard to anticipate that GDP growth in this situation will not have a negative effect on itself (Newell, Prest & Sexton, 2021).

Import volume may suffer from a nation's Gross Domestic Product (GDP) growing significantly (Okyere & Jilu, 2020). An expanding economy typically denotes higher domestic economic activity and a population with more purchasing power. In this setting, rising domestic output and rising local goods consumption frequently accompany GDP growth.

A nation's currency exchange rate can be strengthened by GDP growth, which is frequently seen as a reliable indication of economic health (Morina et al., 2020). An expanding economy frequently sparks greater interest from investors in that nation, which raises the demand for that nation's currency. Since domestic currency is in greater demand and has a limited supply, a rise in capital inflow can support the currency exchange rate.

Export volume may suffer significantly from a rise in a nation's Gross Domestic Product (GDP) (Dogan et al., 2020). Increased domestic output and consumption frequently follow an expansion in a nation's GDP and economy. In these circumstances, consumers are more likely to favor consuming things made in their own country, which lessens their reliance on imports.

A nation's Gross Domestic Product (GDP) can be considerably enhanced by a strong currency exchange rate (Khan, Teng & Khan, 2019). Stronger currency exchange rates tend to lower the cost of domestic goods for customers abroad, which boosts demand for exports. Increasing sales of exported items can bring in more money for domestic businesses, which can boost GDP and national income.

A country's import volume can be greatly enhanced by a stronger currency exchange rate (Thuy & Thuy, 2019). Because local consumers must exchange less of their own currency to obtain the

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foreign currency required to pay for imports, the price of imported items decreases when the domestic currency exchange rate strengthens.

The currency exchange rate itself benefits greatly from a stronger currency exchange rate (Dornbusch, 2019). A strengthening currency's exchange rate indicates greater trust in the nation's economy on the global stage. The demand for that nation's currency may rise as a result of increased interest from foreign investors.

A nation's export volume can be greatly enhanced by a strong currency exchange rate (Dogru, Isik, & Sirakaya-Turk, 2019). Export goods are more affordable for the global market when the home currency exchange rate rises since less foreign money is required to purchase them. As a result, export goods are more appealing to customers abroad and become more competitive on the worldwide market.

The Gross Domestic Product (GDP) of a nation can be severely impacted by a big decline in currency exchange rates (Khan, Teng & Khan, 2019). Imported items may cost more when the domestic currency exchange rate declines because it becomes more expensive to convert foreign currencies into domestic currency. For businesses that rely on importing specific components or raw materials, the result is an increase in production costs that may reduce their profitability.

Import volume may be severely impacted by a notable decline in a nation's domestic currency exchange rate (Thuy & Thuy, 2019). Because more units of the home currency are needed to purchase the same amount of foreign currency needed for imports, the price of imported products increases in the home currency when the currency exchange rate declines.

The exchange rate itself may be significantly harmed by a decline in a nation's local currency exchange rate (Frenkel, 2019). A decline in the currency exchange rate indicates a country's economic fragility and may raise concerns in the foreign exchange market. There might be a decline in interest from foreign investors in that nation, which would lower demand for its currency on the global market.

Export volume may be severely impacted by a notable decline in a nation's domestic currency exchange rate (Singhal, Choudhary & Biswal, 2019). The price of exported goods decreases for the global market when the currency exchange rate declines since less foreign money is needed from customers abroad to purchase these commodities.

Research Method

Type and Source of Data
The study employs a research methodology that utilizes data derived from the World Bank, which is categorized as secondary data. The dataset encompasses time series data spanning from 1991 to 2022, with Indonesia as the focal point of the analysis. The primary variables under scrutiny in this research are exports, GDP (Gross Domestic Product), imports, and exchange rates. The study aims to explore the interplay and evolution of these variables throughout the designated timeframe. To achieve a comprehensive insight into the interrelations among these variables, the research will hinge on the systematic processing and econometric examination of statistical data.

Analysis Method
The objective of this research is to examine the effects of international trade on the economic performance of a nation. It utilizes pivotal variables such as Exports, Imports, Exchange Rate, and GDP for analysis. The Vector Error Correction Model (VECM) is employed to assess the interconnections among these variables. VECM, an advancement of the vector autoregressive

model (VAR), is adept at elucidating both the immediate and enduring dynamics among time-series variables that are integrated. It incorporates the concept of co-integration, which reveals the enduring bonds between the variables (Morshed & Hossain, 2022). Additionally, the model's error correction component is designed to rectify short-term disequilibria. Details on the variables and their sources of data will be provided subsequently.

Table 1. Variable Description

Gross Domestic Product (GDP)	The aggregate measure of a nation's economic output; the sum of all goods and services generated within a specified timeframe.	Unit of Measure
Exports	The aggregate monetary worth of all goods and services that one nation exports to another.	US Dollar (USD)
Imports	The aggregate monetary worth of all goods and services that one nation imports from another.	US Dollar (USD)
Exchange Rate	The comparative valuation of two different currencies; the quantity of one nation's currency that can be traded for the currency of another nation.	US Dollar (USD)

VECM is employed to scrutinize the enduring associations among the specified variables (Morshed & Hossain, 2022). The mathematical framework of VECM is composed of equations that represent the long-term equilibrium (cointegration) and an error correction mechanism. These mathematical expressions are designed to reflect both the immediate and extended impacts of fluctuations in these variables. The specifics of the mathematical model utilized are as follows:

$$\Delta y_t = \alpha \beta^T y_{t-1} + \Sigma_{i-1}^{p-1} \Pi_i \Delta y_{t-i} + \varepsilon_t$$

Descriptions:
Δy_t is the vector of changes in the variables at time t
y_{t-1} is the vector of the variables' values at time $t-1$
α is the vector of constants
β^T is the vector of long-term coefficients
Π_i is the matrix of short-term error correction coefficients for i-th lag
ε_i is the vector of residuals
GDP is Gross Domestic Product
NT is Exchange Rate
X is Export
M is Import
So, our VECM model for this case will consist of four equations, each describing the change in one variable as a function of the variable's value at the previous time and the changes in the other variables at the previous time.
Stationarity Test: A test for stationarity is conducted to verify whether the variables in the model exhibit stationary characteristics. Typically, the analysis of time series data necessitates the use of variables that are stationary. Differencing: If necessary, perform differencing on non-stationary variables to make them stationary. This differencing is often done on variables to eliminate trends or seasonality. Lag Determination: Determine the appropriate lag for the VECM model. This lag selection can be done based on a lag test or based on theoretical considerations. VAR Model Estimation: Perform Vector Autoregression (VAR) model estimation using the

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previously prepared time series data. The VAR model is the first step in forming a VECM. Cointegration Test: A cointegration test is carried out to confirm the presence of a cointegration link among the model's variables. Establishing this relationship is crucial as the VECM hinges on the existence of cointegration among its variables. VECM Model Estimation: Upon verification of a cointegration relationship, proceed to estimate the VECM model with the designated time series data. The model will incorporate an error correction mechanism to address short-term discrepancies within the cointegrated variables. Impulse Response Function (IRF): The outcomes of the VECM (Vector Error Correction Model) estimation contribute to a critical component of the VAR model analysis, specifically the Impulse Response Function (IRF) analysis. The IRF analysis serves as a technique to evaluate how an endogenous variable reacts to unexpected changes in another variable. It also measures the duration and effect of these shocks on the system. The IRF allows for the examination of the effects of a one standard deviation independent alteration. It tracks the influence of a one standard error disturbance, viewed as an innovation, from one endogenous variable to another. Forecast Error Variance Decomposition (FEVD): FEVD analysis, also known as forecast error variance decomposition, delineates the contribution of one variable's innovation to the variance of other variables within a VAR framework. FEVD provides insights into the extent of the variance in a sequence that is attributable to its own innovations versus those from other variables.

Results and Discussion

The initial phase in obtaining the VECM estimation involves conducting a stationarity test on the data for each variable. As previously mentioned, the presence of stationary data is essential for impacting the outcomes of the VECM estimation. The results of the ADF stationarity test for each variable are presented in Table 2.

Table 2. ADF Test Results Using Intercept at 1st Difference Level

Variable	ADF t-Statistic	Mc Kinnon Critical Value 5%	Prob.	Description
Export	-4.169228	-2.967767	0.0030	Stasioner
Import	-4.724426	-2.967767	0.0007	Stasioner
GDP	-3.712457	-2.963972	0.0090	Stasioner
Exchange Rate	-6.629946	-2.963972	0.0000	Stasioner

Source: Processed Data (Eviews 12)

The analysis in Table 2 reveals the outcomes of the stationarity tests for the four variables. The study's data achieves stationarity at the first difference (I1), exhibiting probability values of (0.0030), (0.0007), (0.0090), and (0.0000) for Exports, Imports, GDP, and Exchange Rate, respectively. These values fall below the significance threshold of 5%, thereby qualifying the data for subsequent analysis to ascertain the optimal lag, which will determine the most suitable lag at which the indicators perform optimally.

In the research, the optimal lag length is identified by examining the maximum value of the sequential modified LR test statistic. The range of lag length considered is from 0 to 2, which is deemed appropriate given the annual data spanning 32 years. This lag length adequately captures the dynamics of beef imports from 1991 to 2022. The details of the optimal lag length are displayed in Table 3.

Table 3. Lag Length Testing Using LR Value

Lag Length	Value of Sequential Modified LR Test Statistic
0	NA

| 1 | 27.89510 |
| 2 | 16.34250 |

Source: Processed Data (Eviews 12)

Table 3 indicates that the most suitable lag length is 1, as it has the highest value of the sequential modified LR test statistic, recorded at (27.89510). Consequently, lag 1 is selected as the optimal lag for this research. With the determination of the optimal lag, the next step involves conducting a cointegration test.

For the estimation of VECM to proceed, a prerequisite is the existence of a cointegration relationship among the variables (Lee & Rhee, 2022). In the absence of such a relationship, VECM estimation is not feasible, and one must resort to employing the VAR (Vector Autoregression) model. This research utilizes the Johansen's Cointegration Test, accessible through Eviews 12 software, with a significance level set at 0.05. The findings of the cointegration test are detailed in Table 4.

Table 4. Results of Cointegration Test (Johansen's Cointegration Test)

Hypothesized No. Of CE(s)	Eigenvalue	Trace Statistic	Critical Value (0.05)	Prob.**
None*	0.669500	50.07779	47.85613	0.0304
At Most 1	0.342949	19.07764	29.79707	0.4073
At Most 2	0.201926	7.317805	15.49471	0.5410
At Most 3	0.035163	1.002279	3.841465	0.3168

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Processed Data (Eviews 12)

Table 4 indicates that, at the 5% significance level, there exists a single cointegration rank among the variables. This is substantiated by the Trace Statistic, which stands at (47.85613), surpassing the Critical Value of (0.05) set at (0.0304). This suggests a long-term (cointegration) association between the variables. Consequently, the VECM estimation is applicable for this research, and a stability test for the VECM can be subsequently conducted.

Prior to applying the VECM estimation, it is essential to conduct a stability test of the model. This test is designed to ascertain the reliability of the Impulse Response Function (IRF) and Variance Decomposition (VDC). The results of the VECM stability test are detailed in Table 5.

Table 5. Results of VECM Estimation Stability Test

Root	Modulus
0.425002 - 0.732024i	0.846454
0.425002 + 0.732024i	0.846454
-0.520758 – 0.398105i	0.655497
-0.520758 + 0.398105i	0.655497
0.621418	0.621418
-0.196719 – 0.546654i	0.580973
-0.196719 + 0.546654i	0.580973
0.042349	0.042349

Source: Processed Data (Eviews 12)

Table 5 demonstrates that the model in question is stable, as evidenced by the modulus values averaging below one. Consequently, the findings from the Impulse Response Function (IRF) and Variance Decomposition (VDC) analyses are credible, paving the way for additional examinations like the Granger causality test.

This research focuses the causality analysis on the impact of international trade on Indonesia's economy, specifically examining exports, imports, and Gross Domestic Product (GDP). The Granger causality test is conducted with a 5 percent confidence level and considers up to lag 1, in line with the previously determined optimal lag length. The outcomes of the Granger causality test are presented in Table 6.

Table 6. Granger Causality Test

Null Hypothesis	Obs	Lag1	
		F-Statistic	**Prob**
Import doen't Granger Cause GDP	30	4.21348	0.0265
GDP doen't Granger Cause Import	30	8.45851	0.0016
Kurs doen't Granger Cause GDP	30	2.40315	0.1110
GDP doen't Granger Cause Kurs	30	1.67544	0.2076
Export doen't Granger Cause GDP	30	0.22510	0.8000
GDP doen't Granger Cause Export	30	2.14894	0.1377
Kurs doen't Granger Cause Import	30	1.97376	0.1600
Import doen't Granger Cause Kurs	30	1.43265	0.1377
Export doen't Granger Cause Import	30	13.9168	0,00009
Import doen't Granger Cause Export	30	9.91870	0.0007
Export doen't Granger Cause Kurs	30	1.25023	0.3037
Kurs doen't Granger Cause Export	30	2.22083	0.1295

Source: Processed Data (Eviews 12)

Analysis of Table 6 reveals that imports have a statistically significant effect on GDP, as indicated by a probability value of (0.0265). Conversely, GDP also exerts a statistical influence on imports, with a probability value of (0.0016). Moreover, exports are shown to have a statistical impact on imports, denoted by a probability value of (0.00009), and imports similarly affect exports significantly, with a probability value of (0.0007). Therefore, it can be deduced that a causal relationship exists between these pairs of variables, specifically between imports and GDP, as well as between exports and imports, with a notable statistical significance.

The application of the Vector Error Correction Model (VECM) estimation is pertinent to the research question at hand, which seeks to discern the immediate and extended interrelations among the variables. The estimated outcomes derived from the VECM are delineated in Table 7.

Table 7. Results of Short-Term Vector Error Correction Model (VECM)

Error Correction:	D(GDP,2)	D(M,2)	D(NT,2)	D(X,2)
CointEq1	0.401377 (0.16396) [2.92990]	0.238778 (0.04101) [5.42542]	-1.265243 (4.81223) [-0.26295]	0.184083 (0.03525) [5.26031]
D(GDP(-1),2)	0.427400 (0.40270) [1.06134]	-0.180947 (0.12937) [1.39865]	-27.66666 (-14.1464) [-1.95574]	0.182725 (0.09557) [1.91141]
D(GDP(-2),2)	-0.294319 (0.45857) [-0.64197]	-0.089856 (0.14732) [-0.60993]	5.151090 (16.1091) [-0.31976]	-0.138103 (-0.10883) [-1.26897]
D(M(-1),2)	2.458668 (2.40080) [1.03535]	1.987732 (0.77129) [2.57716]	37.61533 (84.3374) [0.44601]	1.759096 (0.56977) [3.08739]
D(M(-2),2)	1.663931 (1.64215) [1.01326]	0.840631 (0.52756) [1.59342]	-12.82289 (57.6870) [-0.22228]	0.670254 (0.38972) [1.71983]

D(NT(-1),2)	0.040743	0.014920	-1.305202	0.011850
	(0.01042)	(0.00335)	(0.36592)	(0.00247)
	[3.91143]	[4.45838]	[-3.56691]	[4.79365]
D(NT(-2),2)	0.014046	0.003824	-0.623089	0.002720
	(0.00965)	(0.00310)	(0.33888)	(0.00229)
	[1.45603]	[1.23382]	[-1.83868]	[1.18800]
D(X(-1),2)	-3.459124	-2.491014	7.959694	-2.361912
	(2.23095)	(0.71672)	(78.3710)	(0.52946)
	[-1.55051]	[-3.47556]	[0.10156]	[-4.46099]
D(X(-2),2)	-1.822449	-1.003449	19.20456	-0.986298
	(1.63908)	(0.52658)	(57.5792)	(0.38899)
	[-1.11187]	[-1.90561]	[0.33353]	[-2.53551]
C	6.511514	3.423402	-0.029980	3.803277
	(10.2548)	(3.29450)	(360.241)	(2.43372)
	[0.63497]	[1.03913]	[-8.3e-05]	[1.56274]

To assess the significance of relationships between variables in the VECM model, researchers compare the t-statistic values with the critical t-values. If the t-statistic exceeds the critical t-value, it indicates a significant relationship between variables.

The critical t-value at a significance level of 0.05 is 2.048407.

Source: Processed Data (Eviews 12)

Short-term relationships can be established by considering the comparison between coefficient values and t-statistics. When the t-statistic for a variable exceeds its coefficient value, it signifies a significant relationship. Based on Table 6, we observe that for the GDP variable lagged by one period (GDP (-1)), there is an insignificant positive relationship with GDP. This is because the coefficient value 0.427400 is smaller than the t-statistic [1.06134]. Similarly, the relationship between GDP and exports is also insignificant. Additionally, there is an insignificant negative relationship between GDP and imports, as the coefficient value -0.180947 is smaller than the t-statistic [1.39865]. The same pattern holds for the relationship between GDP and exchange rates. Analysis of Table 6 reveals that the import variable, when lagged by one period (import (-1)), shows a coefficient value 1.987732 that is less than the t-statistic [2.57716], signifying a statistically significant positive effect of imports on themselves. Additionally, the relationship between imports and exports is positively correlated but not statistically significant. Similarly, the positive correlation between imports and GDP is not statistically significant, as the coefficient value 2.458668 is greater than the t-statistic [1.03535]. This pattern is also observed in the relationship between imports and exchange rates.

Table 6 indicates that the lagged exchange rate variable (exchange rate (-1)) has a coefficient of 0.040743, which exceeds the t-statistic value of [3.91143] suggesting a significant and positive influence on GDP. A similar significant relationship is observed between the exchange rate and the import-export dynamic. Moreover, the exchange rate exhibits a significant negative effect on itself, as reflected by a coefficient of -1.305202 and a t-statistic of [-3.56691].

Lastly, the export variable (-1) has an insignificant negative relationship with GDP, as its coefficient of -3.459124 is smaller than the t-statistic value of -1.55051. Similarly, the relationship between exports and imports is also negatively significant, with a coefficient value -2.491014 and a t-statistic value [-3.47556]. In other words, the analysis suggests a minor positive link between exports and exchange rates, indicated by a coefficient value of 7.959694, which is not statistically significant when compared to the t-statistic of [0.10156].

Table 8: Long-Term Vector Error Correction Model (VECM) Estimation Results

Variable	Coefficient	Standard Error	t-Statistic

| D(GDP(-1))	1.000000	-	-
D(M(-1))	-21.83777	(3.72704)	[-5.85298]
D(NT(-1))	-0.068586	(0.02356)	[-2.91126]
D(X(-1))	16.20244	(4.09350)	[3.95809]
C	15.13487	-	-

*If the t-statistic value is greater than the critical t-table value, the relationship is considered significant.
*t-table for degrees of freedom (dk) 1 at a significance level of 0.05 is 2.048407. Source: Eviews 12 (processed data)

Source: Processed Data (Eviews 12)

Table 8 indicates that, in the long-term VECM analysis, both the exchange rate and imports negatively impact the model significantly. The t-statistics for these variables are [-5.85298] and [-2.91126], surpassing the critical t-value of 2.048407. Conversely, exports demonstrate a notable positive influence, as evidenced by a t-statistic of [3.95809]. Therefore, any variation in the exchange rate, exports, and imports at the third lag is expected to induce long-term alterations in the model's variables.

The VECM estimation not only examines the effects of independent variables on dependent ones but also includes tools like the IRF and FEVD to analyze how variables react over time and the extent to which each independent variable contributes to the dependent variable's behavior (Gylych et al., 2020). The analysis proceeds with an examination of the IRF graph, as depicted below.
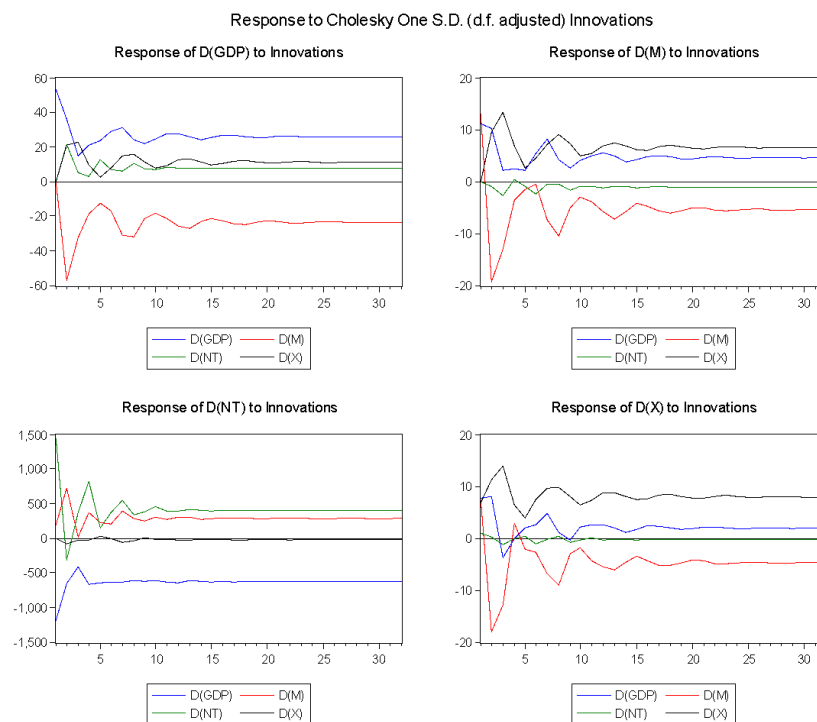
Figure 1. IRF (Impulse Response Function) graph between the variables GDP, Exports, Imports, and Exchange Rate

The processing results in the form of 16 IRF graphs as shown above provide a visual depiction of the response of a variable over the next 32 periods due to a shock of 1 standard deviation, either from itself or from other variables. Based on Figure 1, the GDP response to shocks that occur on itself or three other variables fluctuates at the beginning of the period and reaches equilibrium at different periods. The GDP response to the average exchange rate shock tends to reach equilibrium faster than the other three variables, namely in the 10th period. Meanwhile, the GDP

response to shocks that occur at the average level of import variables and itself tends to be the same towards its equilibrium level, namely in the 15th period. Shocks that occur at the average level of export variables reach equilibrium in the 20th period.

Then, the import response to shocks that occur on itself or three other variables also fluctuates at the beginning of the period. The up-and-down condition of the import response will reach equilibrium in the 15th period (against shocks from the exchange rate, exports, and itself) and the 20th period (against shocks from GDP). Furthermore, the exchange rate response to shocks that occur on GDP tends to reach equilibrium faster when entering the 5th period. Meanwhile, the exchange rate response to shocks that occur on imports, exports, and itself tends to vary towards equilibrium, namely when entering the 15th period, the 20th period, and the 10th period.

Next, the export response to shocks that occur on two other variables tends to be the same (GDP and itself), that is, it will head towards equilibrium in the 20th period. In addition, the export response to shocks that occur on two other variables tends to be the same (imports and exchange rates), that is, it will head towards equilibrium in the 15th period.

The next analysis is by looking at the Forecast Error Variance Decomposition (FEVD), as listed in Table 9 to Table 12.

Table 9. FEVD for the GDP variable

Periode	S.E.	D(GDP)	D(M)	D(NT)	D(X)
1	53.22661	100.0000	0.00000	0.00000	0.00000
2	91.34889	49.50069	39.76796	5.515351	5.215996
3	100.7836	42.75752	43.11275	7.748051	-93.18685
4	-105.0580	-43.23570	-42.88370	-4.430339	-9.450265
5	-109.2082	-44.74526	-41.03850	-5.436022	-8.780219
6	-114.7080	-46.88754	-39.38911	-5.285595	-8.437763
7	-123.9347	-46.54044	-40.09124	-7.763624	-8.604496
8	-131.5315	-44.63849	-41.48838	-4.810198	-9.062929
9	-135.6103	-44.53588	-41.46445	-4.828053	-9.171612
10	-139.4812	-45.24951	-40.97366	-4.812648	-9.864182

Source: Processed Data (Eviews 12)

Table 9 presents the FEVD figures across ten periods for GDP. In the short term, such as the 3rd period, it's evident that self-originating shocks account for a 42.76% variation (reduction) in GDP. Conversely, in the long term, like the 10th period, the variations due to GDP's own shocks rise to 45.25%, and the proportion of GDP variations resulting from shocks in the other three variables diminishes relative to earlier periods.

Table 10. FEVD for the Import (M) variable

Period	S.E.	D(GDP)	D(M)	D(NT)	D(X)
1	17.09976	41.56288	58.43712	0.00000	0.00000
2	29.39832	26.05638	63.52100	0.106384	10.31623
3	35.02910	18.71437	58.77843	0.705672	21.80163
4	35.94519	18.21713	56.87935	0.679122	24.24404
5	36.14440	18.33294	56.44146	0.745357	24.48204
6	36.90983	19.76810	54.15200	1.139774	49.94012
7	39.21024	21.95228	51.58044	1.027731	53.49555
8	41.81410	20.29387	51.79616	0.920215	68.89976
9	42.86092	19.67347	50.72377	1.037039	28.56572
10	43.45283	20.01448	49.85077	1.066795	29.06975

Source: Processed Data (Eviews 12)

Table 10 illustrates the FEVD values for imports across ten periods. In the short term, such as in the 3rd period, GDP shocks are observed to induce an 18.71% fluctuation (decline) in imports. In the long term, like in the 10th period, the fluctuations from shocks to economic growth rise to 10.01%, yet they are still more pronounced than those from the import's own shocks, which stand at 49.85%. Notably, over the ten periods, the fluctuations in imports due to export shocks show an increasing trend.

Table 11. FEVD for the Exchange Rate (NT) variable

Period	S.E.	D(GDP)	D(M)	D(NT)	D(X)
1	1869.795	40.11656	1.038956	58.84448	0.000000
2	2135.917	40.26341	12.18505	47.38956	0.161980
3	2207.470	41.20266	11.41468	47.21133	0.171334
4	-2474.100	-40.30916	-11.26679	-48.27739	0.146672
5	-2572.199	-43.61527	-11.23708	-45.00242	0.145230
6	-2684.148	-45.69904	-10.92962	-43.23691	0.134428
7	-2840.885	-45.90924	-11.69407	-42.23304	0.136640
8	-2938.208	-47.24007	-11.84539	-40.74170	0.172847
9	-3037.826	-48.44159	-11.68303	-39.71366	-0.161713
10	-3145.928	-49.03952	-11.76427	-39.04367	-0.152547

Source: Processed Data (Eviews 12)

Table 11 shows the FEVD values for the exchange rate over ten periods. In the short term, such as the 3rd period, GDP shocks lead to a 41.20% fluctuation (rise) in the exchange rate. Looking at the long term, for instance in the 10th period, the fluctuations from GDP shocks grow to 49.04%. However, these are less significant when compared to the fluctuations caused by the exchange rate's own shocks at 39.04%, imports at 11.76%, and exports at 0.15%.

Table 12. FEVD for the Export (X) variable

Period	S.E.	D(GDP)	D(M)	D(NT)	D(X)
1	12.63197	37.53156	32.61089	0.422344	29.43521
2	25.92909	18.57027	55.98647	0.107348	25.33591
3	32.36456	13.33741	51.98316	0.236407	34.44302
4	33.11100	12.74324	50.39760	0.226764	36.63240
5	33.45637	12.83720	49.77200	0.235792	37.15501
6	34.50285	12.64963	47.40365	0.335889	39.61083
7	36.79157	12.85726	45.27868	0.298200	41.56766
8	39.17534	11.40963	45.43406	0.276828	42.87947
9	40.10822	10.89159	43.92959	0.302954	44.87586
10	40.70757	10.85870	42.89132	0.306014	45.94396

Source: Processed Data (Eviews 12)

Table 10 shows the FEVD values for the realized export value over ten periods. In the short term, such as the 3rd period, GDP shocks result in a 13.33% change in exports. Over the long term, observed in the 10th period, the impact of GDP shocks on exports begins to wane, registering at 10.86%, whereas the export's own shocks account for a significant variation in the realized investment value, amounting to 45.94%.

Conclusions

The analysis conducted confirms the efficacy of the Vector Error Correction Model (VECM) for examining the interplay among imports, GDP, exchange rate, and exports within the Indonesian context. Initially, the Augmented Dickey-Fuller (ADF) test verified data stationarity at the first

difference, satisfying the prerequisite for all variables. Subsequently, the optimal lag length for the VECM was identified as lag 1 through the sequential modified LR test statistic. The Johansen's Cointegration Test established a cointegration relationship among the variables, laying a robust foundation for further VECM estimation. The VECM's stability was affirmed, corroborating the Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) findings. The Granger causality test unveiled significant causal links between imports and GDP, as well as between exports and imports. VECM estimation is used in accordance with the problem formulation in the research to identify short-term and long-term relationships between variables. The VECM estimation results show short-term relationships between variables by considering the coefficient values and t-statistics. In the long term, the exchange rate and import variables have a significant negative effect on GDP, while exports have a significant positive effect The IRF analysis visually illustrates how variables react to shocks, delineating temporal and intensity variations in response. The FEVD analysis enriches the understanding of each variable's influence on the volatility of others in both short and long-term scenarios. Collectively, these insights enhance comprehension of Indonesia's economic variable dynamics, enabling stakeholders to devise more informed and adaptive economic policies in response to these variables' fluctuations.

Suggestions

To rephrase, the conducted analysis yields several recommendations to bolster Indonesia's economic strategy. Primarily, the government should fortify import and export policies, mindful of their causal links with GDP. Implementing suitable incentives, refining trade regulations, and enhancing infrastructure could propel local economic expansion. Additionally, it's crucial for the government to persistently oversee and regulate exchange rate stability. Through judicious monetary and fiscal measures, coupled with strategic foreign exchange market interventions, the exchange rate's steadiness can be preserved, mitigating its adverse effects on GDP and imports.

In facing fluctuations in imports and exports, efforts to diversify the economy need to be strengthened. This can be done through investment in alternative sectors that have potential for growth, as well as the development of domestic markets. Thus, dependence on certain external sectors or markets can be reduced, increasing Indonesia's economic resilience to global shocks. Lastly, it is important for the government to have responsive and stable policies in dealing with economic shocks both domestically and abroad. Sustainable fiscal policies, appropriate monetary policy interventions, and steps to reduce economic uncertainty need to be prioritized. Thus, the government can enhance the effectiveness of economic policies and manage risks associated with the dynamics of relationships between key economic variables.

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