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DETERMINANTS OF FOREIGN EXCHANGE RESERVES USING THE VECTOR ERROR CORRECTION MODEL (VECM) APPROACH

Yoga Arya Pratama[1*], Sumiyarti[2], Mona Adriana[3]
[1,2,3]Faculty of Economic and Business, Universitas Trisakti
*****Corresponding author e-mail*: yogaaryapratama@gmail.com

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ABSTRAK

Penelitian ini bertujuan untuk menganalisis pengaruh determinan cadangan devisa menggunakan pendekatan *Vector Error Correction Model (VECM)*. Variabel yang digunakan dalam penelitian ini antara lain cadangan devisa sebagai variabel dependen dan yang menjadi variabel independen antara lain Keterbukaan Perdagangan, indeks harga konsumen, investasi langsung (PMA), nilai tukar rupiah terhadap dollar, pinjaman luar negeri, inflasi dan uang beredar. Penelitian ini menggunakan métode analisis *Vector Error Corection Model* (VECM) selama periode Q1 2004 s.d. Q4 2024. Pengolahan data yang dilakukan menunjukkan bahwa variabel keterbukaan perdagangan dan uang beredar memiliki pengaruh signifikan dalam jangka panjang. Variabel Keterbukaan Perdagangan berpengaruh positif secara signifikan terhadap cadangan devisa. Berdasarkan hasil analisis VECM, menunjukkan bahwa Keterbukaan Perdagangan berpotensi berdampak terhadap peningkatan cadangan devisa.

Kata Kunci: Cadangan Devisa; *VECM*; Keterbukaan Perdagangan; Uang Beredar.

ABSTRACT

This study aims to analyze the influence of foreign exchange reserves on determinants using the Vector Error Correction Model (VECM) approach. The variables used in this study include foreign exchange reserves as the dependent variable. In contrast, the independent variables comprise trade openness, the consumer price index, direct investment (FDI), the rupiah exchange rate against the dollar, foreign loans, inflation, and money supply. This study used the Vector Error Correction Model (VECM) analysis method for the period Q1 2004 to Q4 2024. Data analysis revealed that trade openness and money supply variables have a significant long-term impact. Trade Openness has a significant positive effect on foreign exchange reserves. The VECM analysis results indicate that Trade Openness has the potential to increase foreign exchange reserves.

Keywords*: Foreign Exchange Reserves; VECM; Trade Openness; Money Supply.*

A. INTRODUCTION

Indonesia's economic recovery continues amidst high global uncertainty. Indonesia's economic growth is projected to remain strong in 2024, supported by domestic demand and maintained price stability. Developments over the past five years have demonstrated

Indonesia's economic performance, characterized by maintained stability and relatively high growth. Economic growth has been above 5% since 2018, except during the COVID-19 pandemic. Inflation has remained low, averaging below 3% from 2018 to 2023, and the rupiah exchange rate against the US dollar has remained stable. The fiscal deficit remains low, below 3% of GDP, except during the peak COVID-19 period in 2020 and 2021, when it quickly recovered through government fiscal consolidation. The current account deficit is also low and declining, even recording a surplus in 2021 and 2022. These developments demonstrate the increasingly strong external resilience of the Indonesian economy.

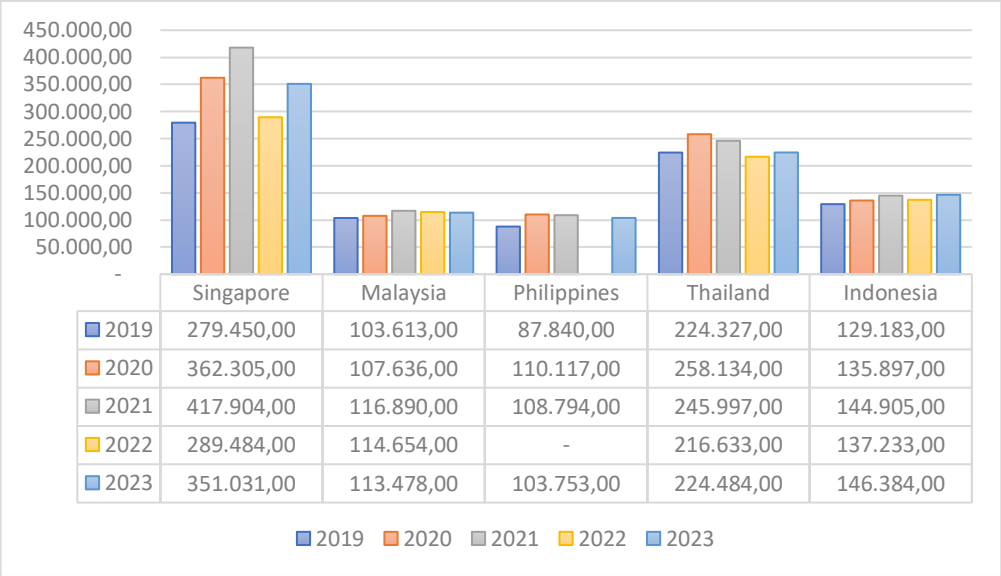
Table 1. Indonesia's Economic Performance 2018-2023
Source: Indonesian Economic Report 2024

Indicators	Unit	2018	2019	2020	2021	2022	2023
Economic Growth	%	5.17	5.02	-2.07	3.70	5.31*	5.05**
Current Account	% GDP	-2.94	-2.71	-0.42	0.30	1.00	-0.16
Fiscal Deficit	% GDP	-1.82	-2.20	-6.14	-4.57	-2.35	-1.61
CPI Inflation	%	3.13	2.59	1.68	1.87	5.51	2.61
Rupiah Exchange Rate	IDR/USD (average)	14.246	14.139	14.525	14.296	14.873	15.247
BI Rate	%	6.00	5.00	3.75	3.50	5.50	6.00

Note: *Preliminary Figures, **Very Provisional Figures

One indicator of Indonesia's economic capacity to demonstrate external resilience is its foreign exchange reserves. Foreign exchange reserves play a crucial role in supporting monetary policy and exchange rate management, including the ability to intervene in the foreign exchange market to support the national currency. Adequate foreign exchange reserves will reduce external vulnerability by maintaining foreign currency liquidity to cushion shocks during crises (International Monetary Fund, 2001).

Foreign exchange reserves can represent Indonesia's foreign trade situation. A country's higher foreign exchange reserves indicate its ability to generate foreign exchange. Conversely, a lower foreign exchange reserve will affect the value of its currency. Therefore, many countries consistently increase their foreign exchange reserves to prevent sharp fluctuations in exchange rates (Manurung, 2016). The following is a comparative trend of Indonesia's average foreign exchange reserves with those of several ASEAN countries, as shown in Graph 1.



	Singapore	Malaysia	Philippines	Thailand	Indonesia
2019	279.450,00	103.613,00	87.840,00	224.327,00	129.183,00
2020	362.305,00	107.636,00	110.117,00	258.134,00	135.897,00
2021	417.904,00	116.890,00	108.794,00	245.997,00	144.905,00
2022	289.484,00	114.654,00	-	216.633,00	137.233,00
2023	351.031,00	113.478,00	103.753,00	224.484,00	146.384,00

Chart 1. Indonesia's foreign exchange reserves compared to several ASEAN countries from 2019 to 2023 (USD million)
Source: Data Processed Based on SEKI Table 9.5 from BI (Foreign Exchange Reserves of Several Countries/Regions (Billion USD))

In line with efforts to increase foreign exchange reserves, Bank Indonesia (BI) has issued Bank Indonesia Regulation (PBI) Number 7 of 2023 concerning Export Proceeds (DHE) and Import Payments (DPI). This regulation was created to support national economic stability by narrowing the gap between exports and imports, thereby creating a positive export-import balance (Trade Openness) and increasing foreign exchange reserves. Trade Openness can be measured as the extent to which a country participates in the global trade market (Thabana & Fasanya, 2024). Exports are expected to make a positive contribution to increasing foreign exchange reserves. When exports increase, foreign income also increases, which in turn adds to foreign exchange reserves. Conversely, if import costs exceed export revenues, this can lead to a decline in foreign exchange reserves (Naima, Mony, & Lalon, 2024).

Substantial foreign exchange reserves are also a factor that encourages foreign investment because they indicate that foreigners can reap profits from the country where they invest. Investment in Indonesia is divided into two categories: foreign investment (also known as foreign direct investment or PMA) and local or domestic investment (also known as domestic direct investment or PMDN) (Manurung, 2016).

Furthermore, high inflation also increases production costs, making nationally produced goods less competitive, both for domestic consumption and for export. This will encourage increased imports, which will impact foreign exchange reserves. The Consumer Price Index (CPI) is the most widely used measure in calculating inflation (Utari, Cristina S., & Pambudi, 2015). The CPI is compiled from the prices of goods and services that the public consumes.

Furthermore, data on planned PLN withdrawals and payments are suspected to help estimate the potential demand for foreign currency to repay maturing loan obligations. High demand for foreign currency, if not anticipated adequately through appropriate policies, will lead to domestic market volatility, which in turn can put pressure on the stability of the Rupiah exchange rate and ultimately affect the achievement of the inflation target. In this regard, the accuracy of information regarding planned PLN withdrawals and payments is crucial for the effective management of foreign exchange reserves (Jacobs et al., 2008).

So, what happens if the money supply is so limited that it cannot finance economic activities? Or conversely, what happens if the money supply is so abundant, while economic activity is relatively small to finance? In this case, if the money supply increases, interest rates tend to fall. This decrease in interest rates will lower the cost of financing investment activities, which in turn encourages investment and overall economic activity (Solikin & Suseno, 2002). Lower interest rates can reduce the attractiveness of foreign investment due to lower returns on investment. Foreign investors may seek markets with higher interest rates to achieve better returns. Research (Thabana & Fasanya, 2024) found that the ratio of money supply to GDP has a significant impact on foreign exchange reserves, indicating that the money supply largely determines foreign exchange reserves in Sub-Saharan Africa. Therefore, the money supply is suspected of indirectly influencing foreign exchange reserves.

Thabana & Fasanya (2024) estimated that local currency depreciation against the US dollar would weaken the local currency, thereby reducing foreign exchange reserves. In contrast, currency appreciation would strengthen the local currency, thereby supporting increased foreign exchange reserves. Therefore, the exchange rate is expected to affect foreign exchange reserves. Based on applicable provisions related to exchange rates, as stated in Syarifuddin (2016), regulations regarding Indonesia's exchange rate system and foreign exchange flows are contained in Law No. 24 of 1999 concerning Foreign Exchange

Flows and the Exchange Rate System. This law affirms that the foreign exchange system adopted in Indonesia is a free foreign exchange system, with the exchange rate determined by the government after considering recommendations from Bank Indonesia. Bank Indonesia's authority over foreign exchange reserves, as stipulated in this law, includes foreign exchange reserve management, development of the foreign exchange market, and management of the exchange rate. Against this background, this study aims to identify factors influencing foreign exchange reserves in both the short and long term. These factors include Trade Openness, FDI, CPI, Inflation, PLN, Money Supply, and the Rupiah Exchange Rate against the US Dollar.

B. RESEARCH METHOD

The methodology used in this study is quantitative, to explore and analyze the influence of independent variables on the dependent variable using a vector error correction model. Foreign exchange reserves serve as the dependent variable, while trade openness, foreign direct investment (FDI), CPI, inflation, foreign exchange (PLN), money supply, and the rupiah exchange rate against the US dollar serve as independent variables. This study employed quantitative research. Sugiyono (2018) argues that quantitative research is a research method based on the philosophy of positivism, which examines a population or sample.

This study employed secondary analysis, which involves analyzing previous data using analytical tools and testing hypotheses. Time series data was used in this study. The purpose of this study was to determine whether the independent variables (trade openness, FDI, CPI, inflation, foreign exchange, money supply, and the rupiah exchange rate against the US dollar) influence the dependent variable (foreign exchange reserves) and have the potential for cointegration at first difference (lag 1) in the short and long term.

This study collected data through secondary searches conducted by Bank Indonesia between 2019 and 2024 on topics such as PBI No. 7 of 2023, foreign exchange reserves, Natural Resource Exports, Natural Resource Imports, the USD Exchange Rate, Inflation, and Investment. Additionally, the information collected was sourced from relevant literature, including documents, articles, notes, archives, and scientific readings pertinent to the research topic. Data analysis in this study used the Vector Error Correction (VECM) method using E-Views.

C. RESULTS AND DISCUSSION

1. Stationarity Test

The first step in obtaining a VECM estimate is to test the stationarity of the data for each variable, including both the dependent variable and the independent variable. In this study, to detect whether each variable's data is stationary or not, the ADF (Augmented Dickey Fuller) test is used using the intercept model. From these results, it can be seen that the statistical ADF value is smaller than its critical value, so it can be concluded that the data on foreign exchange reserves, Consumer Price Index, Inflation, Foreign Direct Investment, Rupiah Exchange Rate Against the US Dollar, Trade Openness, Foreign Loans, and Money Supply do not contain a unit root and mean the data is stationary at the first difference (first difference) Firdaus (2011). The ADF stationary test for each variable can be shown in Table 5 as follows:

Table 2. Stationarity Test Results at the Level

Variables	ADF T-statistic	Critical Values 1% level	Critical Values 5% level	Critical Values 10% level	Description
Foreign Exchange Reserves	2.143620	-2.593121	-1.944762	-1.614204	Stationary Point
CPI	-0.314000	-2.593121	-1.944762	-1.614204	Not Stationary
Inflation	-2.526235	-2.596586	-1.945260	-1.613912	Not Stationary
FDI	-0.599197	-2.596160	-1.945199	-1.613948	Not Stationary
Rupiah Exchange Rate against the US Dollar	1.776197	-2.593824	-1.944862	-1.614145	Not Stationary
Trade Openness	-0.919786	-2.593121	-1.944762	-1.614204	Not Stationary
Foreign Loans	3.654247	-2.593121	-1.944762	-1.614204	Not Stationary
Money Supply	2.163347	-2.594563	-1.944969	-1.614082	Not Stationary

Table 3. Results of Stationarity Test with Intercept at the Level

Variable	ADF T-statistic	Critical Values 1% level	Critical Values 5% level	Critical Values 10% level	Description

Foreign Exchange Reserves	-0.790241	-3.511262	-2.896779	-2.585626	Not Stationary
CPI	-2.367333	-3.511262	-2.896779	-2.585626	Not Stationary
Inflation	-2.168222	-2.901217	-2.901217	-2.587981	Not Stationary
FDI	-3.482672	-3.515536	-2.898623	-2.586605	Not Stationary
Rupiah Exchange Rate against the US Dollar	-0.301574	-3.513344	-2.897678	-2.586103	Not Stationary
Trade Openness	-2.266406	-3.511262	-2.896779	-2.585626	Not Stationary
Foreign Loans	-0.177950	-3.511262	-2.896779	-2.585626	Not Stationary
Money Supply	2.265034	-3.515536	-2.898623	-2.586605	Not Stationary

Table 4. Results of Stationarity Test with Trend and Intercept at Level

Variable	ADF T-statistic	Critical Values 1% level	Critical Values 5% level	Critical Values 10% level	Description
Foreign Exchange Reserves	-1.905054	-4.072415	-3.464865	-3.158974	Not Stationary
CPI	-3.051785	-4.072415	-3.464865	-3.158974	Not Stationary
Inflation	-3.077265	-4.088713	-3.472558	-3.163450	Not Stationary
FDI	-7.677399	-4.075340	-3.466248	-3.159780	Stationer
Rupiah Exchange Rate against the US Dollar	-2.802033	-4.073859	-3.465548	-3.159372	Not Stationary
Trade Openness	-2.370623	-4.072415	-3.464865	-3.158974	Not Stationary
Foreign Loans	-1.990566	-4.072415	-3.464865	-3.158974	Not Stationary
Money Supply	-1.382127	-4.078420	-3.467703	-3.160627	Not Stationary

From the table above, it can be explained that the variables that are not stationary in the intercept and trend & intercept at the level include foreign exchange reserves, Trade Openness, FDI, CPI, Inflation, PLN, Money Supply and Rupiah Exchange Rate against the US Dollar, because the ADF T statistic value is < the Critical Value Level value of 5%. Because not all variables are stationary at the ADF test level, according to Firdaus' explanation (2011), the solution is to differentiate the data at the first difference level. The results of the ADF test at the first-difference level are presented in Table 8 below:

Table 5 Results of Stationarity Test on First Difference

Variable	ADF T-statistic	Critical Values 1% level	Critical Values 5% level	Critical Values 10% level	Description
Foreign Exchange Reserves	-7.066442	-2.593468	-1.944811	-1.614175	Stationary
CPI	-8.001964	-2.593468	-1.944811	-1.614175	Stationary
Inflation	-3.976415	-2.596586	-1.945260	-1.613912	Stationary
FDI	-9.456609	-2.596160	-1.945199	-1.613948	Stationary
Rupiah Exchange Rate against the US Dollar	-6.968926	-2.593824	-1.944862	-1.614145	Stationary
Trade Openness	-10.22459	-2.593468	-1.944811	-1.614175	Stationary
Foreign Loans	-8.100780	-2.593468	-1.944811	-1.614175	Stationary
Money Supply	-0.165827	-2.594946	-1.945024	-1.614050	Not Stationary

Then the results of the ADF test at the first difference level for the Money Circulation variable are still not stationary at the first difference level, so data differentiation is carried out at the second difference level, which can be shown in Table 9 as follows:

Table 6 Results of Stationarity Test on Second Difference

Variable	ADF T-statistic	Critical Values 1% level	Critical Values 5% level	Critical Values 10% level	Description
Money Supply	-9.423660	-2.594946	-1.945024	-1.614050	Stationary

2. Optimal Lag Test

VECM estimation is highly sensitive to the lag length of the data used. Lag length is used to determine the time required for the influence of each variable on its past variables. In this study, the lag length is determined by looking at the Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quin Criterion (HQ). Based on the FPE value, the optimum lag in this model is 4, as shown in Table 10:

Table 7 Lag Length Test Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3444.827	NA	4.03e+33	100.0819	100.3410*	100.1847*
1	-3367.263	134.8946	2.75e+33	99.68877	102.0200	100.6137
2	-3315.632	77.81973	4.23e+33	100.0473	104.4508	101.7943
3	-3251.217	82.15229	5.07e+33	100.0353	106.5110	102.6044

4	**-3132.998**	**123.3590***	**1.58e+33**	**98.46372**	**107.0116**	**101.8550**
5	-3074.369	47.58350	3.94e+33	98.61938	109.2395	102.8327
6	-2993.714	46.75634	9.83e+33	98.13664*	110.8290	103.1721

3. VAR Stability Test

The VAR stability test is performed by calculating the roots of the polynomial function, also known as the roots of the characteristic polynomial. If all the roots of the polynomial function are within the unit circle or if their absolute value is less than 1, the VAR model is considered stable, and the resulting Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) are considered valid. Figure 8 in the Appendix shows that the roots of the polynomial function are within the unit circle and their absolute value is less than 1. The VAR stability test results indicate that the VAR model is stable and valid.

4. Cointegration Test (Johannsen Cointegration Test)

The cointegration test in this study uses the Johannsen approach by comparing the trace statistic with the critical value of five percent. If the trace statistic is greater than the critical value of 5%, then cointegration exists in the system of equations. The results of the cointegration test are shown in Table 8 as follows.:

Table 8 Results of Johannsen Cointegration Test

Statistical Trace Test				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**Critical Value 5%**	**Prob.**
None *	0.671822	**207.7097**	143.6691	0.0000
At most 1 *	0.405197	**128.6014**	111.7805	0.0028
At most 2*	0.344602	**91.71519**	83.93712	0.0122
At most 3*	0.282592	**61.71681**	60.06141	0.0360
At most 4	0.221457	38.13696	40.17493	0.0790
At most 5	0.178904	20.36341	24.27596	0.1441
At most 6	0.080387	6.368196	12.32090	0.3925
At most 7	0.005874	0.418252	4.129906	0.5813
Uji Maximum Eigenvalue				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max- Eigen Statistic**	**Critical Value 5%**	**Prob.**
None *	0.671822	**79.10825**	48.87720	0.0000
At most 1	0.405197	36.88626	42.722	0.1928
At most 2	0.344602	29.99838	36.63019	0.2416
At most 3	0.282592	23.57985	30.43961	0.2796
At most 4	0.221457	17.77355	24.15921	0.2881
At most 5	0.178904	13.99521	17.79730	0.1706
At most 6	0.080387	5.949943	11.22480	0.3554

At most 7	0.005874	0.418252	4.129906	0.5813

From Table 6 above, it can be explained that in the model, at the 5 percent (5%) test level, there are 4 cointegration equations. This is evident from the trace statistic value being greater than the critical value of 5%. According to Firdaus (2011), if the trace statistic > critical value, the equations are cointegrated. Thus, H0 = non-cointegration, with the alternative hypothesis H1 = cointegration. If the trace statistic > critical value, then reject H0 or accept H1, which means cointegration occurs.

5. Vector Error Correction Model (VECM) Estimation

After conducting a series of pre-estimation steps, including data stationarity testing, lag length determination, stability testing, and cointegration testing, and recognizing the presence of four ranks of cointegration at the 0.05 (5%) level in this study, the VECM model was used. The use of VECM estimation aligns with the research problem formulation, which is to identify the influence of independent variables on the dependent variable in the short and long term. The results of the VECM estimation are shown in Table 9.

Table 9 VECM Estimates of Short-Term and Long-Term Effects

Long-term					
Variables	**Coefficient**	**Standar Error**	**T statistic**	**T table 5%**	**Decision**
CPI (-1)	-328.2950	417.839	-0.78570	1.99167	Negative Not Significant
INFLATION (-1)	892.8689	1830.35	0.48781	1.99167	Positive Not Significant
FDI (-1)	-0.551726	0.58207	-0.94787	1.99167	Negative Not Significant
EXCHANGE EXCHANGE (-1)	-12.16674	8.79433	-1.38348	1.99167	Negative Not Significant
TRADE OPENNESS (-1)	10.92261	2.22471	4.90968	1.99167	Positive Significant
FOREIGN BORROWING (-1)	0.513130	0.36574	1.40298	1.99167	Positive Not Significant
MONEY SUPPLY (-2)	-1413293.	170863.	-8.27152	1.99167	Negative

Short-term					
Variable	**Coefficient**	**Standar Error**	**T statistic**	**T table 5%**	**Decision**
CPI (-1)	-3.33E-05	0.00011	-0.31636	1.99167*	Negative Not Significant
INFLATION (-1)	-3.40E-05	2.4E-05	-1.39310	1.99167*	Positive Not Significant
FDI (-1)	-0.030075	0.01787	-1.68297	1.66515**	Negative Not Significant
EXCHANGE EXCHANGE (-1)	-0.001011	0.00421	0.23998	1.99167*	Negative Not Significant
TRADE OPENNESS (-1)	-0.107429	0.01963	-5.47138	1.99167*	Positive Significant
FOREIGN BORROWING (-1)	-0.006972	0.09577	-0.07280	1.99167*	Positive Not Significant
MONEY SUPPLY (-2)	1.86E-06	7.9E-07	-2.37106	1.99167*	Negative

Source: Author, processed results, (2024)
Note: Significance levels are *5% and **10%

Table 9 shows that in the short term, only FDI, Trade Openness, and Money Supply significantly impact foreign exchange reserves. Meanwhile, CPI, Inflation, the Rupiah Exchange Rate against the US Dollar, and Foreign Loans are insignificant. This could be because one variable reacts to another variable with a lag, and generally, the reaction of one variable to another occurs over the long term. Therefore, for the variables FDI, Trade Openness, and Money Supply, there is evidence of a short-term to long-term adjustment mechanism, as indicated by significant, negative cointegration errors.

Table 12 also shows that in the long term, only the variables Trade Openness and Money Supply significantly impact foreign exchange reserves. Trade Openness has a significant positive effect on foreign exchange reserves; a one percent increase in Trade Openness increases foreign exchange reserves by 10.92261 percent. Meanwhile, the Money Circulation variable has a significant negative effect on foreign exchange reserves, namely when there is a one percent increase in Money Circulation, foreign exchange reserves will experience a decrease of -1413293 percent.

Impulse Response Function (IRF) Analysis

After estimating the VECM, an IRF analysis is conducted to illustrate how a variable responds to a shock, both within itself and about other independent variables. To identify the response of foreign exchange reserves to the IRF in this VECM model, the standard

Cholesky Decomposition is used, as described in Firdaus (2011). In this study, the period analyzed for the response of foreign exchange reserves to shocks in the variables of Trade Openness, FDI, CPI, Inflation, PLN, Money Supply, and the Rupiah Exchange Rate against the US Dollar is projected over the next 24 months (2 years).

Response of Foreign Exchange Reserves to Foreign Exchange Reserves

A shock of one standard deviation in Foreign Exchange Reserves in the first month will increase foreign exchange reserves by 4,835,373. In the fifth month, the foreign exchange reserve shock is negatively responded to by foreign exchange reserves, decreasing by 375,1712. However, starting in the eighth month, a positive response was observed, resulting in an increase of 2,522,771 in foreign exchange reserves. From the eighth month through the next 24 months (2 years), the foreign exchange reserves fluctuated in response to the shocks, and over time, these shocks resulted in a positive growth trend in the 24th month.

Foreign Exchange Reserves Response to Trade Openness

In the first month, the foreign exchange reserves response was 0, indicating no initial change. However, in the second month, there was a significant spike of 357,2471, indicating an increase in foreign exchange reserves. The third month showed a slight decrease of -12,09466, followed by a slight increase in the fourth month of 53,82227. The fifth month showed a significant decrease of -622,219.7, indicating a substantial decline in foreign exchange reserves. Fluctuations continued, with some months showing increases and others showing decreases. Overall, the response of foreign exchange reserves to Trade Openness exhibited an unstable pattern with large fluctuations over the 24 months.

Foreign Exchange Reserves Response to FDI

In the first month, a one-standard-deviation FDI shock appeared unresponsive. In the second month, foreign exchange reserves decreased by -322.6222, followed by an increase of 252.3805 in the third month. This fluctuation indicates that foreign exchange reserves initially responded unstably to changes in direct investment. In period 6, there was an increase of 409.7564, followed by a decrease of -138.0846 in period 7. This fluctuation continued until the fifteenth month, with response values varying between -457.1306 and 77.62312. According to the long-term VECM estimation results, negative FDI was not significantly affected by foreign exchange reserves. This can be seen in the twentieth month,

when the foreign exchange reserve response approached zero, with a value of 1.320789, indicating that the impact of the shock on direct investment was beginning to subside.

Foreign Exchange Reserve Response to CPI

Foreign exchange reserves did not appear to respond to a CPI shock of one standard deviation in the first month. From the second month through the long-term period (24 months), the CPI shock appeared to be negatively responded to by foreign exchange reserves, as indicated by fluctuating declines in both short-term and long-term reserves. In the second month, foreign exchange reserves declined by -785.4155. In the sixth month, this decline increased to -20.05540. From the seventh month through the next 24 months (2 years), the foreign exchange reserve response fluctuated to the CPI shock, and over time, this shock resulted in a negative downward trend in the CPI until the 24th month. According to the VECM estimates, neither the short-term nor the long-term negative CPI had a significant impact on foreign exchange reserves. Therefore, fluctuations in the IRF analysis of the foreign exchange reserve response to the CPI did not significantly affect foreign exchange reserves.

Foreign Exchange Reserves Response to Inflation

In the first month, the inflation shock of one standard deviation appeared to be unresponsive. In the second month, foreign exchange reserves increased by 374,349 units. This likely reflects Bank Indonesia's initial response to stabilize the economy by increasing foreign exchange reserves. After this initial response, foreign exchange reserves experienced significant fluctuations. In the third month, foreign exchange reserves decreased to 35,335,25 units, and in the fourth month, they fell to -70,001,18 units. These fluctuations indicate instability in the foreign exchange reserves' response to inflation. Between the sixth and eighth months, foreign exchange reserves experienced a sharp decline, reaching a deficit of -568,999 units. This decline was likely due to ongoing inflationary pressures and could provide a basis for Bank Indonesia to utilize its foreign exchange reserves to stabilize the currency. After the sharp decline, foreign exchange reserves began to recover in the ninth month, increasing by 129,414 units. However, fluctuations persisted, with repeated increases and decreases until the 24th month. According to the long-term VECM estimation results, positive inflation has no significant impact on foreign exchange reserves. This is evident from the response of foreign exchange reserves to inflation shocks, which began to reach

equilibrium in the long-term period, namely in the 24th month, where foreign exchange reserves showed a slight decrease of -13.51724.

Response of Foreign Exchange Reserves to Money Supply

In the first month, the response of foreign exchange reserves was 0, indicating no initial change. However, in the second month, there was a significant spike of 1,132,641, indicating an increase in foreign exchange reserves. The third month showed a significant decrease of -865,6235, followed by a slight increase in the fourth month of 47.40955. The fifth month saw a significant increase in foreign exchange reserves, with a large spike of 1,325,924, indicating a substantial rise. Fluctuations continued, with some months showing increases and others showing decreases. Overall, the response of foreign exchange reserves to the money supply exhibited an unstable pattern, characterized by large fluctuations, over the 24 months.

Foreign Exchange Reserves Response to the Rupiah (USD) Exchange Rate

In the first month, a one-standard-deviation investment shock appeared unresponsive. In the second month, foreign exchange reserves decreased by -322.6222, followed by an increase of 252.3805 in the third month. This fluctuation indicates that foreign exchange reserves initially responded unstably to changes in direct investment. In period 6, there was an increase of 409.7564, followed by a decrease of -138.0846 in period 7. This fluctuation continued until the fifteenth month, with response values varying between -457.1306 and 77.62312. According to the long-term VECM estimation results, negative investment was not significant for foreign exchange reserves. This can be seen in the twentieth month, when the foreign exchange reserve response approached zero, with a value of 1.320789, indicating that the impact of the shock on direct investment was beginning to subside.

Foreign Exchange Reserves Response to Foreign Loans

In the first month, the foreign loan shock of one standard deviation appeared to have no effect. In the first month, the foreign exchange reserve response was 0, indicating no initial change. However, in the second month, there was a significant spike of 634.6423, indicating an increase in foreign exchange reserves. The third month showed a slight decrease of -61.16897, followed by a significant decrease in the fourth month of -331.8145. The fifth month showed a significant increase of 329.0141, indicating a substantial rise in

foreign exchange reserves. Fluctuations continued, with some months showing increases and others showing decreases.

Variance Decomposition (VD)

Based on the results of variance decomposition, it can be concluded that in the first month, the fluctuation in foreign exchange reserves was primarily caused by the foreign exchange reserve shock itself, accounting for 100 percent. However, from the second month through the first year (12 months), other variables began to influence the variability of foreign exchange reserves. In the first year, the average role of money supply in explaining fluctuations in foreign exchange reserves remained dominant, at 10.13 percent. Meanwhile, the Rupiah exchange rate against the dollar came in second, at 6.93 percent. Foreign direct investment (FDI) also appeared to play a role in explaining fluctuations in foreign exchange reserves during this period, at 3.88 percent. Meanwhile, foreign loans, trade openness, CPI, and inflation appeared to have little impact on the variability of foreign exchange reserves, contributing only 2.82 percent, 2.63 percent, 1.64 percent, and 0.81 percent, respectively.

Then, in the second year, the average role of money supply in explaining fluctuations in foreign exchange reserves remained dominant, at 11.74 percent. Meanwhile, the Rupiah exchange rate against the dollar came in second, at 9.74 percent. Foreign direct investment (FDI) also appeared to play a role in explaining fluctuations in foreign exchange reserves during this period, at 5.60 percent. Meanwhile, Foreign Loans, Trade Openness, CPI, and Inflation do not appear to have a significant influence on the variability of foreign exchange reserves, with each contributing a role of 5.24 percent, 4.64 percent, 3.02 percent, and 1.75 percent, respectively.

D. CONCLUSION

Based on the data from the VECM model estimation results, IRF analysis and VD analysis show that the results obtained from this test can be concluded that: 1) The hypothesis of Trade Openness has a positive effect on foreign exchange reserves has been proven. Based on the results of the VECM estimation in the short term, Trade Openness has a significant adverse effect. This is also supported by the results of the IRF analysis in the fifth month, which shows a considerable decrease of -622.2197, indicating a significant decrease in foreign exchange reserves. Based on the results of the VECM estimation in the long term, Trade Openness has a significant positive effect. Based on the VD analysis, Trade Openness

in the first year affects the variability of foreign exchange reserves by 2.63 percent and in the second year by 4.64 percent; 2) The hypothesis of FDI has a positive effect on foreign exchange reserves, but this is not proven. Based on the results of the VECM estimation in the short term, FDI has a significant adverse effect. This is also supported by the results of the IRF analysis, which show a decrease in period 7 of -138.0846. This fluctuation continued until the fifteenth month, with response values varying between -457.1306 to 77.62312. Based on the results of the long-term VECM estimation, negative FDI was not found to be significant in influencing foreign exchange reserves. Based on the VD analysis, FDI in the first year affected the variability of foreign exchange reserves by 3.88 percent and in the second year by 5.60 percent; 3) The hypothesis that the CPI has a positive effect on foreign exchange reserves was not proven. Based on the results of the VECM estimation in both the short and long terms, the CPI has an adverse effect that is not statistically significant. This is also supported by the results of the IRF analysis, which shows that from the seventh month to the next 24 months (2 years), the response of foreign exchange reserves fluctuated in response to the CPI shock. The longer this shock persisted, resulting in a negative downward trend in the CPI, continued until the 24th month. Based on the VD analysis, the CPI in the first year affected the variability of foreign exchange reserves relatively low, at 1.64 percent, and in the second year, by 3.02 percent. 4) The hypothesis that inflation has a significant adverse effect on foreign exchange reserves is not proven. Based on the results of the short-term VECM estimation, inflation has an insignificant adverse effect. This can be seen in the IRF analysis, starting in the third month, where foreign exchange reserves decreased to 35.33525, and in the fourth month, it fell to -70.00118. Meanwhile, the results of the long-term VECM estimation show that inflation has an insignificant positive effect. This is evident in the IRF analysis, which begins in the ninth month with an increase of 129.4147. However, fluctuations continue to occur with repeated increases and decreases until the 24th month. The contribution of inflation to influencing the variability of foreign exchange reserves is very low, based on the VD analysis, which shows a contribution of only 0.81% in the first year and 1.75% in the second year. 5) The hypothesis that PLN has a positive effect on foreign exchange reserves is not proven. Based on the results of the short-term VECM estimation, PLN has an insignificant adverse effect. In line with the IRF analysis, the third month showed a slight decrease of -61.16897, followed by a significant decrease in the fourth month of -331.8145. The results of the VECM estimation in the long term indicate

that PLN has a positive, but insignificant, effect. Based on the VD analysis, PLN in the first year affects the variability of foreign exchange reserves relatively low at 2.82 percent and in the second year at 5.24 percent; 6) The hypothesis of Money Supply has a positive effect on foreign exchange reserves, but this is not proven. Based on the results of the VECM estimation, the money supply has a significant adverse effect in both the short term and the long term. Based on the VD analysis, Money Supply predominantly influences the variability of foreign exchange reserves relatively high at 10.13 percent and in the second year at 11.74 percent; 7) The hypothesis of the Rupiah Exchange Rate Against the Dollar has a positive effect on foreign exchange reserves, but this is not proven. Based on the results of the VECM estimation, the Rupiah Exchange Rate Against the Dollar has a positive, but insignificant, effect in the short term and a negative, but insignificant, effect in the long term. Based on the VD analysis, the Rupiah exchange rate against the dollar was found to be the most dominant factor influencing the variability of foreign exchange reserves, accounting for 6.93 percent in the first year and 9.74 percent in the second year.

REFERENCES

Adhitya, B. (2021). Analisis Determinan Cadangan Devisa di Indonesia. *Jurnal Ilmiah Universitas Batanghari Jambi*, 1.

Asnah, & Dyanasari. (2021). *Pengantar Ilmu Ekonomi Makro.* Yogyakarta: Deepublish.

Cancer, S. Y., & Sentosa, S. U. (2023). Faktor-Faktor Yang Mempengaruhi Cadangan Devisa Indonesia. *Jurnal Kajian Ekonomi dan Pembangunan*, 73.

Carkovic, M., & Levine, R. (2002). *Does Foreign Direct Invesment Accelerate Economic Growth.* Minnesota: niversity of Minnesota.

Dananjaya, I. P., Jayawarsa, A. K., & Purnami, A. S. (2019). Pengaruh Ekspor, Impor, Kurs Nilai Tukar Rupian, Dan Tingkat Inflasi Terhadap Cadangan Devisa Indonesia Periode 1999-2018. *Warmadewa Economic Development Journal*, 1-8.

Deddy, M. A., Adriyanto, A., & N, R. D. (2023). Strategi Hilirisasi Di Indonesia Dalam Menghadapi Kebijakan Larangan Ekspor Bijih Nikel Terhadap Tingkat Pengangguran Dan Cadangan Devisa Negara. *JISIP (Jurnal Ilmu Sosial dan Pendidikan)*, 1-7.

Dunn, W. N. (2017). *Public Policy Analysis : An Integrated Approach.* New York: Taylor and Francis.

Firdaus, M. (2011). *Aplikasi Ekonometrika Untuk Data Panel dan Time Series.* Bogor: PT Penerbit IPB Press.

Fitri, N., Sentosa, S. U., & Adry, M. R. (2019). Pengaruh Investasi dan Utang Luar Negeri Terhadap Cadangan Devisa Indonesia. *Jurnal Ecosains Ilmiah Ekonomi dan Pembangunan*, 36.

Fitri, N., Sentosa, S. U., & Adry, M. R. (2019). Pengaruh Investasi dan Utang Luar Negeri Terhadap Cadangan Devisa Indonesia. *Jurnal Ecosains, Universitas Negeri Padang*, 35-48.

Fortuna, A. M., Muljaningsih, S., & Asmara, K. (2021). Analisis Pengaruh Ekspor, Nilai Tukar Rupiah, dan Utang Luar Negeri Terhadap Cadangan Devisa Indonesia. *Jurnal Ilmiah Ekonomi, Manajemen dan Akuntansi*, 1-8.

Gandhi, D. V. (2006). *Pengelolaan Cadangan Devisa di Bank Indonesia.* Jakarta: Pusat Pendidikan dan Studi Kebansentralan (PPSK) Bank Indonesia.

Ihsan, M. (2018). Analisis Cadangan Devisa Indonesia Tahun 1994-2015. *Jurnal Universita Islam Indonesia*, 2-21.

IMF. (1999). *Macroeconomic Accounting in Transition Economy.* International Monetary Found.

International Monetary Fund. (den 20 September 2001). *Guidelines for Foreign Exchange Reserve Management.* Hämtat från International Monetary Fund: https://www.imf.org/

Jacobs, P., Arlyana, A., Chani, E. M., Utari, G. D., Siswantoro, Eko, . . . Siallagan, T. E. (2008). *Manajemen Pinjaman Luar Negeri Swasta Indonesia : Pelajaran Berharga Dari Krisis Keuangan Indonesia.* Jakarta: PT Elex Media Komputindo.

Jalunggono, G., Cahyani, Y. T., & Juliprijanto, W. (2020). Pengaruh Ekspor, Impor dan Kurs Terhadap Cadangan Devisa Indonesia Periode Tahun 2004 - 2018. *Jurnal Ekonomi, Bisnis dan Akuntansi (JEBA) Volume 22 No.2 Tahun 2020*, 173-174.

Juliansyah, H., Moulida, P., & Apridar. (2020). Analisis Faktor-faktor Yang Mempengaruhui Cadangan Devisa Indonesia. *Jurnal Ekonomi Regional Unimal, Volume 3 Nomor 2 Agustus 2020*, 32-46.

Kaplan, A., & Laswell, H. (1970). *Power and Society: A Framework for Political Inquiry.* New Haven: Yale University Press.

Kartini, S. (2019). *Mengenal Inflasi.* Semarang: Mutiara Aksara.

Khusnatun, L. L., & Hutajulu, D. M. (2021). Analisis Faktor-Faktor Yang Mempengaruhi Cadangan Devisa Indonesia. *Ekono Insentif*, 79-92.

Maesyaroh, W. U., & Kundhani, E. Y. (2024). Analisis Faktor-faktor yang Mempengaruhi Cadangan Devisa. *Jurnal Ilmu Ekonomi*, 92-109.

Manurung, A. H. (2016). *Cadangan Devisa dan Kurs Valuta Asing.* Jakarta: Kompas Media Nusantara.

Mustari, N. (2015). *Pemahaman Kebijakan Publik.* Yogyakarta: PT Leutika Nouvalitera.

Naima, J., Mony, P. D., & Lalon, R. M. (2024). Determinants of Foreign Exchange Reserve of Emerging Economy: Time Series Evidence from Bangladesh. *International Journal of Economics and Financial Issues*, 9-16.

Naima, J., Mony, P. D., & Lalon, R. M. (2025). Determinants of Foreign Exchange Reserve of Emerging Economy: Time Series Evidence from Bangladesh. *International Journal of Economics and Financial Issues*, 9-16.

Novianti, D. T., & Oktaviani, P. R. (2022). *Teori Makroekonomi 1.* Bogor: PT Penerbit IPB Press.

Palembangan, I. T., Kumaat, R. J., & Mandeij, D. (2020). Analisis Pengaruh Tingkat Bunga Acuan BI, SIBOR dan Nilai Tukar Rupiah Terhadap Cadangan Devisa di Indonesia. *Jurnal Berkala Ilmiah Efisiensi*, 1-13.

Panennungi, M. A., & Xu, N. (2017). *Perekonomian Indonesia dalam Tujuh Neraca Makroekonomi.* Jakarta: Yayasan Pustaka Obor Indonesia.

Prameswari, M., Indrawati, L. R., & Laut, L. T. (2019). Analisis Pengaruh Utang Negeri, Kurs Dollar, dan Inflasi terhadap Cadangan Devisa Indonesia Tahun 2008-2017. *Dinamic: Jurnal Ekonomi Pembangunan*, 1-11.

Pressman, J. L., & Aaron B. Wildavsky. (1973). *Implementation: How Great Expectations in Washington Are Dashed in Oakland.* Berkeley: University of California Press.

Rahmawati, E. Y., Ismanto, B., & Sitorus, D. S. (2020). Analisis Pengaruh Ekspor dan Kurs Terhadap Cadangan Devisa Indonesia Tahun 1990-2019. *Jurnal Ecodunamika*, 1-12.

Rianda, C. N. (2020). Pengaruh Ekspor Impor Terhadap Cadangan Devisa di Indonesia. *At-Tasyri': Jurnal Ilmiah Prodi Muamalah* , 1-9.

Safitri, H., Disty, A. A., Sumah, N. M., Zulaehah, A., & Yuni. (2014). ANALISIS NERACA PERDAGANGAN MIGAS DAN NON MIGAS . *Economics Development Analysis Journal*, 355. Hämtat från www.gramedia.com.

Safitri, Y., & Putri, D. Z. (2022). Analisis Determinan Cadangan Indonesia. *Jurnal Kajian Ekonomi dan Pembangunan*, 100.

Savira, N. P., & Meliza. (2024). Faktor-faktor yang Mempengaruhi Cadangan Devisa di Indonesia. *AT-TAWASSUTH: Jurnal Ekonomi Islam*, 97-114.

Sayoga, P., & Tan, S. (2017). Analisis Cadangan Devisa Indonesia dan Faktor-Faktor Yang Mempengaruhinya. *Jurnal Paradigma Ekonomika Vol.12. No.1, Januari - Juni 2017*.

Solikin, & Suseno. (2002). *UANG Pengertian, Penciptaan, dan Peranannya dalam Perekonomian.* Jakarta: Pusat Pendidikan dan Studi Kebansentralan (PPSK) Bank Indonesia.

Sugiyono. (2018). *Metode Penelitian Kuantitatif, Kualitatif dan R&D.* Bandung: Alfabeta.

Sumiyarti, & Febriana, P. (2014). Pengaruh Kebijakan Makroekonomi Dan Kualitas Kelembagaan Terhadap Foreign Direct Invesment Di ASEAN-6- Analisis Panel Data. *Jurnal Ekonomi Pembangunan Trisakti, Vol 1, No.2*, 159-175.

Suparmoko, M., & Sofilda, E. (2020). *Pengantar Ekonomi Makro.* Tangerang: IN MEDIA.

Syarifuddin, F. (2016). *Konsep, Dinamika dan Respon Kebijakan Nilai Tukar Di Indonesia.* Jakarta: BI Institute.

Thabana, G., & Fasanya, I. (2024). Determinants of foreign exchange reserves in sub-saharan Africa. *Scientific African 26*, 1-11.

Thabana, G., & Fasanya, I. (2024). Determinants of Foreign Exchange Reserves in Sub-Saharan Africa. *Scientific African*, 1-11.

Utari, G. D., Cristina S., R., & Pambudi, S. (2015). Inflasi Di Indonesia : Karakteristik dan Pengendaliannya. i G. D. Utari, R. Cristina S., & S. Pambudi, *No.23 SERI KEBANKSENTRALAN* (ss. 1-62). Jakarta: Bank Indonesia Institute.

Wahongan, G. F., Kumaat, R. J., & Mandeij, D. (2022). Analisis Ekspor Migas, Ekspor Non-Migas dan Penanaman Modal Asing Terhadap Cadangan Devisa di Indonesia Periode 2001-2020. *Jurnal Berkala Ilmiah Efisiensi*, 1-12.

Yusuf, M., & Ichsan, R. N. (2019). Analisis Efektifitas Penggunaan Cadangan Devisa, Utang Luar Negeri dan Ekspor Terhadap Stabilitas Nilai Tukar. *Jurnal Ekonomi dan Kebijakan Publik Indonesia*, 184-193.