

Causality Analysis Between Exchange Rate, Current Balance Sheet, Inflation, and Gross Domestic Product in ASEAN-5 1980-2022

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Abstract

This research investigates the causality between exchange rate, current balance sheet, inflation, and gross domestic product in ASEAN 5 from 1980 to 2022. The method employs the Granger causality test. This research finds weak evidence of a J-curve effect on the current account balance in Indonesia because empirical results with several tests and models reject the J-curve hypothesis and do not find evidence of an influence of the rupiah exchange rate on Indonesia's current account balance in the long term so that it can the conclusion is drawn that: (1) There is no causal relationship between the current account balance and the exchange rate in Indonesia from 1996-2022; (2) Changes in exchange rates affect changes in the current account balance in the short and long term; (3) The mechanism for changes in the current account deficit does not affect changes in the exchange rate.

Keywords: Exchange Rate, Current Balance Sheet, Inflation, Gross Domestic Product, ASEAN.

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1. Introduction

With the majority of countries now operating under an open economy, engaging in international trade of goods, services, and capital, the significance of understanding the economic relationships between these countries has never been more crucial. This research delves into the causality between exchange rate, current balance sheet, inflation, and gross domestic product in ASEAN 5, shedding light on the complex dynamics of these economic factors.

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Foreign currencies and their exchangeability play an important role in cross-world trade. Due to differences in exchange rates, international trade activities always face price differences for goods and services. Currency exchange rates (exchange rates) are needed to facilitate trade between countries. The currency exchange rate is also traded on the foreign exchange (forex) market.

Countries that are part of the Southeast Asian Nations (ASEAN) are also taking open economic action to embrace international integration as a state development strategy. This integration has gone through several steps since 1967 (Klimis, 2016). Through ASEAN, several member countries have experienced high economic growth since 1980. Collectively, ASEAN countries have a GDP of 3 trillion US Dollars. The ASEAN economy is also the fifth largest region after the United States, China, Japan, and Germany (The ASEAN Secretariat, 2021).

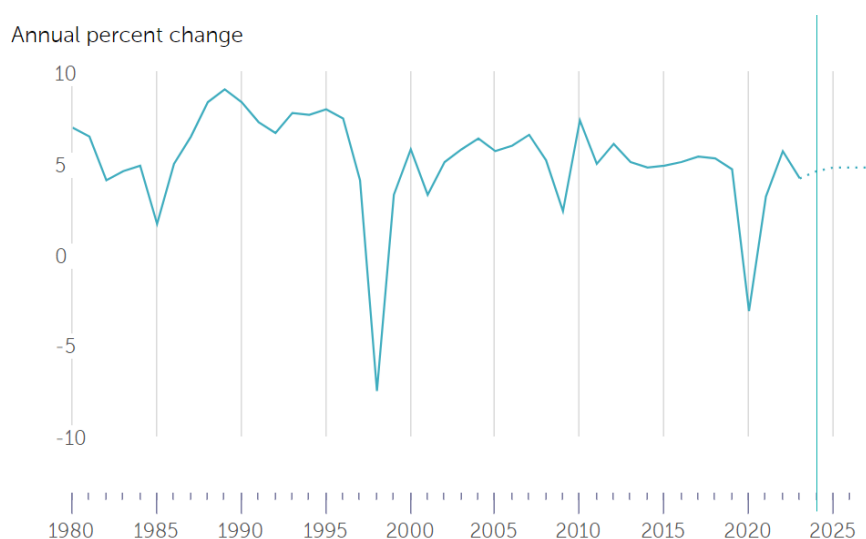


Figure 1. ASEAN Economic Growth Graph 1980-2022 (Source: IMF Website)

The founding countries of ASEAN, Thailand, Indonesia, Malaysia, Singapore, and the Philippines (ASEAN-5), have made a significant shift in their trade performance. They have successfully increased exports of manufactured goods and services, a notable achievement considering their initial focus on primary products. This transition is largely attributed to their ownership of abundant labor and natural resources, which have played a crucial role in supporting their economic growth and development. The role of an open economy, international trade, and foreign direct investment (FDI) in this process cannot be overstated, as they have been instrumental in achieving high economic growth, investment, and exports (Lubis et al., 2017).

Each ASEAN-5 country adheres to a different monetary policy system. This influences economic growth, exchange rates, and inflation that accompanied the five countries from 1980 to 2022. Before the Asian economic crisis in 1997, the Philippine government implemented the most flexible exchange rate regime, while Indonesia, Malaysia, Singapore, and Thailand implemented crawling-band or controlled floating exchange rate policies. As the largest region in ASEAN-5, Indonesia continues to follow crawling-band exchange rate settings, and Thailand pegs its currency into a currency basket. Malaysia and Singapore follow a controlled floating exchange rate regime. Meanwhile, the Malaysian government has officially pegged its currency to the US Dollar since September 1998 (Abdul Rashid, 2009).

After 1998, the ASEAN-5 monetary policy focused on price stability. Indonesia, the Philippines, and Thailand are inflation-oriented and use floating exchange rates, while Malaysia and Singapore 'monitor' the value of their currencies on an 'undisclosed basket' (IMF, 2016). The development of foreign currencies in ASEAN-5 countries is still interesting, especially during the Covid-19 pandemic.

The ups and downs (exchange rates, balance sheets, etc.) of the COVID-19 pandemic (the number of victims/severity/spread of COVID explained again), as well as the frequency and severity of regional quarantines (lockdowns), have raised concerns in developing countries. For developing countries with open economies, their domestic currencies are experiencing vulnerability due to soaring national debt and stagnant or declining economic growth. The COVID-19 pandemic is a shock that requires adjustments in international financial markets (Nur Ain, 2022).

(explained above) ASEAN-5 is a group of regional economic actors, and the five countries rely on each other to facilitate each other's role in the international market. Even though they have one vision for national economic growth, the ASEAN-5 countries have different monetary policies adopted by each country. The conflict between international economic theory and exchange rate experience in ASEAN-5 countries can be an exciting study considering that ASEAN-5 experienced an economic growth crisis simultaneously, for example, the 1997 crisis, with different policy approaches in overcoming this crisis. Research related to the actual impact of depreciation or appreciation, both in the short and long term, is fascinating. Therefore, researchers are interested in "Causality Analysis between Exchange Rates, Current Balance, Inflation and Gross Domestic Product (GDP) in ASEAN-5 Countries 1980-2022."

International economic trade is becoming increasingly widespread among countries worldwide, accompanied by increasingly powerful technological advances and globalization. This international trade is also carried out by the countries that created ASEAN, usually called ASEAN-5. It is hoped that the cooperation carried out will facilitate the steps taken by each country to accelerate their respective domestic economic growth. In this case, many factors influence international trade, such as the exchange rate, current account, inflation, and GDP. These factors have been widely studied in previous research, but only a few have analyzed these four factors and their relationship. This is also interesting, considering that ASEAN-5 has different monetary policies adopted by each country. The conflict between international economic theory and exchange rate experience in ASEAN-5 countries can be an exciting study considering that ASEAN-5 experienced an economic growth crisis simultaneously, for example, the 1997 crisis, with different policy approaches in overcoming this crisis. Based on this background, the author proposes a problem formulation as follows: (1) Is there a short-term and long-term causal relationship between the exchange rate and the current account, inflation, and gross domestic product in ASEAN-5 countries in 1980-2022? (2) Is there a short-term and long-term causal relationship between the current account balance and the exchange rate, inflation, and gross domestic product in ASEAN-5 countries in 1980-2022? (3) Is there a short-term and long-term causal relationship between inflation on the exchange rate, current account, and gross domestic product in ASEAN-5 countries in 1980-2022? (4) Is there a short-term and long-term causal relationship between gross domestic product and the exchange rate, current account, and inflation in ASEAN countries.

2. Literature Review

In international trade, exchange rates have an important role. The exchange rate will affect

exports and imports, where if the foreign exchange rate depreciates, the price of imported goods will increase. Domestic goods will experience an increase in demand both at home and abroad. This condition causes the prices of imported and exported goods to be high. Rising prices of goods and services generally reflect inflation (Sugihyanto, 2021). High prices of goods will reduce people's purchasing power (PPP), where goods sold are no longer purchased and generate profits. In the long term, this causes capital borrowers to withdraw their capital, and capital investment will decrease so that state income will decrease (Ridwan, 2022).

International economic transactions expect a current account surplus for the country's economic growth. A current account deficit will cause capital to withdraw, and the stability of the domestic exchange rate will weaken and experience depreciation. An increase in imports will lead to an increase in domestic inflation due to the implications of increasing prices of imported goods (Alawin & Oqaily, 2017). An increase in demand for goods will only occur when the amount of surplus exports causes an expansion in production and increases national income. On the other hand, a current account deficit can cause a reduction in foreign exchange reserves, so the domestic currency will experience depreciation. Deficits experienced in the long term will lead to a decline in national income (Karkita et al., 2019).

Apart from the exchange rate and current account, the state of a country's domestic economy also plays a vital role in international trade. One of the influencing economic factors is inflation and gross domestic product (GDP). If there is an increase in the exchange rate against the dollar, the domestic currency rate depreciates, and the foreign exchange rate will increase. People will tend to exchange the rupiah they have for foreign currency at the bank, thereby increasing the amount of foreign currency. People's savings increase in the form of foreign currency, and there is excess demand while supply remains constant, so the price of foreign exchange will rise and vice versa. Thus, every change in the foreign exchange rate will affect the country's national income (Sundari, 2017).

Meanwhile, inflation will cause the currency to depreciate against foreign currencies if it increases. (first explanation) If deflation occurs, the domestic exchange rate against foreign currency will appreciate (Noor, 2014). The relationship between inflation and the exchange rate is also influenced by the law of one price in PPP theory, where the price of goods on the international market must be the same as that of domestic commodities. If commodity prices in one country are more expensive than in other countries, demand for currency and commodities will fall. This condition will encourage the exchange rate and domestic prices to return to the same as the PPP value. On the other hand, if domestic prices are cheaper, there will be appreciation and inflation. In the PPP concept, if the law of one price does not occur, then there are economic forces that will encourage equal PPP in all countries.

The exchange rate, current account, inflation, and GDP influence the growth of an open trade economy. Previous researchers have studied these factors. Leonard and Stockman (2001) show the results of a weak relationship between the real exchange rate, current transactions, and real GDP. In agreement with these results, according to Rajan (2003), currency depreciation and appreciation are ineffective ways to correct current account imbalances in the United States.

Meanwhile, inflation is influenced by domestic and external variables. According to Solihin (2011) (change journal update), these variables are Gross Domestic Product (GDP), currency exchange rates, interest rates, money supply, and changes or economic shocks in other countries. (Explain again how variables affect other variables.)

The relationship between the current account balance and the exchange rate has become a concern for economists who want to determine the right strategy choices in developing and increasing a country's development. Hady (2001) suggests a positive relationship exists between the current account deficit and the depreciation of the rupiah in Indonesia. On the other hand, Salman's (2002) research states a 2-way relationship between changes in the current account deficit and changes in the exchange rate in Indonesia.

Meanwhile, according to Ariyani (2018), research results show that GDP hurts current transactions. Short. Variable interest rates hurt current transactions in the long term. The foreign direct investment (FDI) variable hurts current transactions in the long term. Furthermore, the exchange rate variable hurts current transactions in the long term. In line with Ariyani, Syed (2012) revealed that cointegration results from research show a long-term relationship between the current account deficit, fiscal deficit, trade deficit, and exchange rate. Meanwhile, the Granger causality test results show a one-way relationship between the current account deficit and the exchange rate and foreign debt.

The research "Current Account Imbalances and Exchange Rate Volatility: Empirical Evidence from Indonesia" by Haryo Kuncoro and Fafurida (2023) uses current account balance variables, foreign exchange reserves, and foreign exchange rates for the 2005-2021 period in Indonesia, analyzed using GARCH. The results show that the current account balance has a high potential for triggering absolute exchange rate volatility. The research "The Effect of Real Exchange Rate on Current Account" by Moaned Talib Al-Hamdi, Mahmood Alshammari, and Mohammad Alawin (2023) uses the variables real GDP, trade balance, investment, and real exchange rate for the 2008-2022 period in Jordan, analyzed using OLS. The results show that the real exchange rate is not the main factor in determining the current account balance position. In "Current Account Drivers and Exchange Rate Regime in Central and Eastern Europe" by Kersti Harkmann and Karsten Staehr (2021), which uses current account balance and exchange rate variables for the 1997-2017 period in 11 countries, panel data analysis shows that for countries with floating exchange rates, current transactions are driven by domestic factors, while for countries with fixed exchange rates, current transactions are more influenced by external factors, indicating vulnerability to external developments.

The research "Balance of Payments and Exchange Rates in ASEAN Countries: Granger Causality Test" by Rina Aprilia and Rizka Malia (2021) uses balance of payments and exchange rate variables for the 2005-2019 period in 10 ASEAN countries. Analysis using the Granger Causality Test shows that only Myanmar and the Philippines show a causal relationship between the exchange rate and the balance of payments. "The Role of Exchange Rate for Current Account: A Panel Data Analysis" by Flavio Vilela Vieira and Ronald MacDonald (2020) uses current account balance variables, actual exchange rates, and nominal exchange rates for the 1994-2014 period in 58 countries. Panel data analysis shows that there needs to be a consensus on the critical variables in determining the current account, with significant variations in empirical approaches across countries. The research "Current Account Determinants in ASEAN 6 Countries" by Novi Ariyani, Fajar Wahyu Priyanto, and Lilis Yuliati (2018) uses current account balance variables, GDP, exchange rates, FDI, and interest rates for the 2001-2016 period in 6 ASEAN countries. The results show that GDP hurts current transactions in the short term, interest rates negatively affect the long term, FDI hurts the long term, and the exchange rate also hurts the long term.

In the research "The Connection between the Exchange Rate and the Balance of Payments

Accounts in the Czech Republic: An Econometric Approach" by Tomas Urbanovsky (2017), the variables used are the nominal exchange rate, current account balance, and financial transaction balance for the 1995Q1 period -2015Q4. Analysis using the Granger Causality Test shows a long-term balance between the current account balance and the financial transaction balance. The research "Effects of Exchange Rate on Current Account in Fragile Five" by Ahmet Sahbaz (2016) uses current account balance variables, actual exchange rates, and nominal GDP for 1987Q1-2016Q1 in 5 countries. SVAR analysis shows that national currency depreciation effectively reduces the current account deficit in Brazil, Turkey, and Indonesia, but there is no significant relationship between India and South Africa. "Interlinkage Between Real Exchange Rate and Current Account Behaviors: Evidence from India" by Mohamed Arouri, Arif Billah Dar, Niyati Bhanja, Aviral Kumar Tiwari, and Frederic Teulon (2015) uses current account balance variables and actual exchange rates for the period 1975-2011. Analysis using VAR and SVAR shows that genuine exchange rate appreciation drives a steady improvement in India's current account deficit.

The research "Dynamics of Current Account Deficit: A Lesson from Pakistan" by Jawaid Syed Tehseen and Syed Ali Raza (2012) uses current account balance variables, savings, fiscal deficit, trade deficit, foreign debt, and exchange rate for the period 1976-2010. Analysis using the Granger Causality Test shows a long-term relationship between the current account deficit, fiscal deficit, trade deficit, and exchange rate and a one-way relationship between the current account deficit and the exchange rate and foreign debt. In "Effects of Inflation, Interest and Unemployment Rates on Economic Growth: Evidence from ASEAN Countries" by Shrikant Krupasindhu Panigrahi, Noor Azlinna Azizan, Shahryar Sorooshian, and Prabha Thoudam (2020), the variables used are interest rates, unemployment rates, inflation, and GDP for the period 1995-2018. The analysis shows a strong long-term relationship between interest rates, inflation, and economic growth, but the relationship between the unemployment rate and economic growth is insignificant. The Granger test shows a relationship between interest rates, unemployment, inflation, and economic development.

The research "Exchange Rate and Current Account Balance: Evidence from ASEAN-5 Countries" by Cep Jandi Anwar, Indra Suhendra, Rah Adi Fahmi Ginanjar, Suci Hilmianti Oktari, and Deris Desmawan (2022) uses current account variables, exchange rate, FDI per GDP, economic growth, inflation, and market openness for the 1991-2021 period. Panel data model analysis with fixed effects estimation shows that the exchange rate and inflation significantly adversely impact the current account. In contrast, economic growth and FDI have a considerable positive impact. In the research "The relationship of real Gross Domestic Product (GDP), Inflation, and Unemployment in the Philippines (1970-2011)" by Kyle Christine Abalos Pascual, Christine Pauline Dionisio, and Rose Capulla (2020), the variables used are GDP, inflation, and unemployment for the period 1970-2011. The analysis shows significant short-run relationships between real GDP and inflation, real GDP and unemployment, and between inflation and unemployment. "Impact of Exchange Rate Shocks, Inward FDI, and Import on Export Performance: A Cointegration Analysis" by Van Chien Nguyen and Thi Tuyet Do (2020) uses FDI, import, exchange rate, and export variables for the 2009-2018 period. The analysis shows that exports are influenced by the exchange rate in the long run, with large-scale imports influencing exports and increased FDI increasing external markets. In "Exchange Rate Volatility, Inflation, and Economic Growth in Developing Countries: Panel Data Approach for SADC" by Ebenezer Olamide, Kanayo Ogijiuba, and Andrew Maredza (2022), the variables used include exchange rates and inflation for the 2000-2018 period. The analysis shows that

unstable exchange rates and inflation have a negative relationship with economic growth, where exchange rate instability exacerbates the impact of inflation on economic growth.

3. Research Method

This research analyzes the relationship between exchange rates, current account balance, inflation, and gross domestic product in ASEAN-5 countries, Indonesia, Thailand, Malaysia, Singapore, and the Philippines. The data used is secondary data and is quarterly for each variable in the 1980-2021 period. The variables in this research are the exchange rate, current account balance, inflation, and gross domestic product. Several research approaches were used to analyze different types of data. The cointegration test and Granger causality test approaches were carried out before proceeding with vector autoregression (VAR) and error correction ECM models). The data used is secondary data in the form of time series data in ASEAN-5 countries, namely quarterly quantitative data. The data used in the research is secondary data sourced from the official websites of Bank Indonesia and the World Bank. The data used are Exchange Rates, Current Account Balance, Inflation, and Gross Domestic Product. The analytical model used in this research is the cointegration test and Granger causality test to analyze the causal relationship between the exchange rate and the current account balance in Indonesia. Then, it will continue with vector auto-regression and error correction models. This research's model estimation uses the cointegration and Granger causality tests. The cointegration test was carried out to see the long-term relationship between the current account balance and the exchange rate in Indonesia.

Meanwhile, the Granger causality test is used to analyze and see the reciprocal (causal) relationship between the current balance and the exchange rate in Indonesia. The vector auto-regression model was carried out for the influence between relative current transactions and the real Rupiah exchange rate, as well as the impact of the real Rupiah exchange rate on relative current transactions. Meanwhile, error correction models are helpful because they can estimate short-term effects between variables and long-term implications from time series data. This research uses an analytical tool, namely the Granger causality test/GCT. In regression analysis, although one variable influences another variable, the direction of the relationship between these variables is not explained. In other words, a relationship between variables does not indicate causality or the direction of the relationship. GCT indicates whether a variable has a two-way or one-way relationship.

$$CA_t = \sum_{i=1}^n \alpha_i CA_{t-i} + \sum_{j=1}^n \beta_j ER_{t-j} + \mu_{1t}$$

$$ER_t = \sum_{i=1}^n \lambda_i ER_{t-i} + \sum_{j=1}^n \delta_j CA_{t-j} + \mu_{2t}$$

di mana:

CA_{it}: Current balance sheet at t (USD)

ER_{it}: Exchange rate at t (Rp/USD)

μ_{1t}, μ_{2t}: Error term.

4. Findings and Discussions

The ADF test results for the current balance sheet show that the probability is 0.0000, below 0.05, and the coefficient is 0.000, below 0.5, indicating that the current account balance is stationary. Meanwhile, the stationarity test for the exchange rate variable obtained the following results.

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Table 1. ADF Result

Null Hypothesis: D(CA,2) has a unit root

Exogenous: None

Lag Length: 4 (Automatic - based on SIC, maxlag=4)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-8.875993	0.0000
Test critical values: 1% level	-2.588059	
5% level	-1.944039	
10% level	-1.614637	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(CA,3)

Method: Least Squares

Date: 01/10/24 Time: 13:15

Sample (adjusted): 1997Q4 2022Q4

Included observations: 101 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CA(-1),2)	-4.717879	0.531532	-8.875993	0.0000
D(CA(-1),3)	2.633876	0.470921	5.593029	0.0000
D(CA(-2),3)	1.592369	0.358380	4.443237	0.0000
D(CA(-3),3)	0.748110	0.229335	3.262082	0.0015
D(CA(-4),3)	0.298305	0.103950	2.869686	0.0051
R-squared	0.870067	Mean dependent var	-15.01020	
Adjusted R-squared	0.864653	S.D. dependent var	6084.144	
S.E. of regression	2238.331	Akaike info criterion	18.31309	
Sum squared resid	4.81E+08	Schwarz criterion	18.44255	
Log likelihood	-919.8108	Hannan-Quinn criter.	18.36550	
Durbin-Watson stat	1.990143			

The ADF test results for exchange rate show that the probability is 0.000, which is below 0.05, and the coefficient is 0.0000, below 0.5, which indicates that the exchange rate is stationary.

Table 2. Unit Root

Null Hypothesis: D(ER,2) has a unit root

Exogenous: None

Lag Length: 4 (Automatic - based on SIC, maxla...

Augmented Dickey-Fuller test statistic
Test critical values: 1% level
5% level
10% level

*MacKinnon (1996) one-sided p-values.

Table 3. ADF Tes Equation

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(ER,3)

Method: Least Squares

Date: 01/10/24 Time: 13:24

Sample (adjusted): 1997Q4 2022Q4

Included observations: 101 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ER(-1),2)	-3.162768	0.385793	-8.198101	0.0000
D(ER(-1),3)	1.383621	0.331793	4.170132	0.0001
D(ER(-2),3)	1.083458	0.263539	4.111181	0.0001
D(ER(-3),3)	0.748695	0.191549	3.908639	0.0002
D(ER(-4),3)	0.260929	0.098202	2.657068	0.0092
R-squared	0.833085	Mean dependent var	-7.473168	
Adjusted R-squared	0.826130	S.D. dependent var	2344.825	
S.E. of regression	977.7388	Akaike info criterion	16.65660	
Sum squared resid	91773417	Schwarz criterion	16.78606	
Log likelihood	-836.1583	Hannan-Quinn criter.	16.70901	
Durbin-Watson stat	2.042370			

The research results were then continued with the VAR test using the lag length criterion at lag 10. Determining the optimal lag is essential because, in the VAR method, the optimal lag is very useful for eliminating autocorrelation problems in the VAR system, which is used as a VAR stability analysis. The following is a display of the results of the lag length criteria.

Table 4. VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria

Endogenous variables: CAER

Exogenous variables: C

Date: 01/10/24 Time: 14:31

Sample: 1996Q1 2022Q4

Included observations: 98

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1862.521	NA	1.15e+14	38.05144	38.10419	38.07278
1	-1684.003	346.1059	3.26e+12	34.48985	34.64812*	34.55387*
2	-1677.939	11.50783	3.13e+12	34.44774	34.71152	34.55443
3	-1675.473	4.579681	3.23e+12	34.47905	34.84833	34.62842
4	-1673.729	3.169073	3.38e+12	34.52508	34.99987	34.71712
5	-1664.480	16.42033*	3.04e+12*	34.41797*	34.99827	34.65269
6	-1662.330	3.730433	3.16e+12	34.45571	35.14152	34.73311
7	-1658.404	6.650646	3.17e+12	34.45722	35.24854	34.77729
8	-1655.725	4.428379	3.27e+12	34.48418	35.38101	34.84693
9	-1651.800	6.328269	3.28e+12	34.48571	35.48804	34.89113
10	-1650.692	1.740633	3.50e+12	34.54473	35.65258	34.99283

* indicates lag order selected by the criterion
 LR: sequential modified LR test statistic (each test at 5% level)
 FPE: Final prediction error
 AIC: Akaike information criterion
 SC: Schwarz information criterion
 HQ: Hannan-Quinn information criterion

The output results show that the value is at lag 5 for LR FPE and AIC. Meanwhile for SC and HQ it is at lag 1. However, in the future it will use lag 5.

After knowing the optimum output at lag 5, proceed with the stability of the VAR estimation using the AR Roots Table on the lag structure.

Table 5. Root Characteristic Polynomial

Roots of Characteristic Polynomial
 Endogenous variables: CAER
 Exogenous variables: C
 Lag specification: 1 5
 Date: 01/10/24 Time: 14:34

Root	Modulus
0.963557	0.963557
0.803346 - 0.115646i	0.811628
0.803346 + 0.115646i	0.811628
0.563050 - 0.568299i	0.799993
0.563050 + 0.568299i	0.799993
-0.083034 - 0.729388i	0.734099
-0.083034 + 0.729388i	0.734099
-0.626156 - 0.379674i	0.732273
-0.626156 + 0.379674i	0.732273
-0.702080	0.702080

No root lies outside the unit circle.
 VAR satisfies the stability condition.

The output results show that there are no root and modulus values that are more than 1, so the stability requirements are met and are considered stable.

After knowing the reciprocal relationship, then proceed with the cointegration test to determine the long-term relationship. In this case, the Johansen cointegration test is used. The following are the estimation results using the Johansen co-integration test.

The cointegration results above can be seen using the critical value at a confidence level of 5%. The trace statistic value is greater than the critical value at the 5% confidence level and is greater than the eigenvalue. So, there is 1 variable that is cointegrated. Apart from that, there is also an "*" sign in none. The "*" none sign does not exceed 1 sign, so this equation is continued with the vector correction model (VECM) method. The results concluded that the current account balance and exchange rate variables have a stable long-term balance relationship. Meanwhile, in the short term, the current account balance and exchange rate variables adjust to each other for a long-term relationship, which indicates that the that the long term relationship is stronger than the short term

Table 6. Lags Interval

Date: 01/10/24 Time: 14:39
 Sample (adjusted): 1997Q3 2022Q4
 Included observations: 102 after adjustments
 Trend assumption: Linear deterministic trend
 Series: CAER
 Lags interval (in first differences): 1 to 5

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.217808	27.15135	15.49471	0.0006
At most 1	0.020325	2.094549	3.841465	0.1478

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.217808	25.05680	14.26460	0.0007
At most 1	0.020325	2.094549	3.841465	0.1478

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

The results of the Granger Causality Test (GCT) for the current account balance and exchange rate variables are obtained as follows.

Table 7. Pairwise Granger Causality Tes
Pairwise Granger Causality Tests

Date: 01/10/24 Time: 21:40
 Sample: 1996Q1 2022Q4
 Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
CA does not Granger Cause ER	104	1.87044	0.1220
ER does not Granger Cause CA		1.44765	0.2244

The probability value for the current account balance variable on the exchange rate is 0.1220, more significant than 0.05, which indicates that the current account balance has no causal relationship with the exchange rate. Likewise, the probability for the exchange rate variable on the current account balance is 0.2244, more excellent than 0.05, so the exchange rate has no

causal relationship with the current account balance.

The results of the VECM estimation will show the short-term and long-term relationship between the current account balance and the exchange rate. The VECM estimation results for analyzing the short-term and long-term effects of 2 variables can be seen in the following table.

Table 8. VECM estimation

Variabel	Koefisien	T Statistik
CointEq1	-0.035592	-0.81645
D(CA(-1))	-0.0223530	-2.01818
D(CA(-2))	-0.068696	-0.62437
D(CA(-3))	0.048445	0.44140
D(CA(-4))	0.237818	2.18290
D(CA(-5))	0.007323	0.06574
D(ER(-1))	0.596871	2.31189
D(ER(-2))	0.146600	0.58393
D(ER(-3))	0.182931	0.70648
D(ER(-4))	0.054846	0.22010
D(ER(-5))	0.064195	0.24203
C	-28.57639	-0.12943

Based on the results in the table above, there are 7 significant variables at the 5% absolute level in the short term, plus one error correction variable. Significant variables at the 5% absolute level are the current account balance at lags 2 and 4 and the exchange rate at lags 1,2,3,4,5. The alleged significant error correction parameter proves that there is an adjustment mechanism from the short term to the long term. The adjustment amount from short to long-term is -0.03%.

The short-term estimation results reveal the profound impact of the current account balance variable at lag 2, which has a negative effect at the 5% real level of 0.06%. This implies that a mere 1% increase in the previous 2 years would lead to a significant reduction of 0.06% in the current year's current account balance. Similarly, a 1% increase in the current account balance over the previous 4 years would result in a substantial increase of 0.23%. Moreover, a 1% increase in the exchange rate over the previous 1,2,3,4,5 years would lead to a noticeable increase in the current account balance by 0.59%, 0.14%, 0.18%, 0.05%, and 0.06% in the current year.

Table 9. VAR Coefisien

Variabel	Koefisien	T Statistik
ER(-1)	1.890145	4.90551

In the long term, the exchange rate is significant at the actual level of 5%, which affects the current account balance. The exchange rate variable positively influences the current account balance, namely 1.890145%. This means that an increase in the exchange rate will cause the current account balance to increase by 1.890145%. This condition is by exchange rate theory. If it appreciates, the current account balance will experience a surplus.

Table 10. Vector Error Correction Estimate

Vector Error Correction Estimates
Date: 01/10/24 Time: 21:20
Sample (adjusted): 1997Q3 2022Q4
Included observations: 102 after adjustments
Standard errors in () & t-statistics in []

Cointegrating Eq:	CointEq1	
CA(-1)	1.000000	
ER(-1)	1.890145 (0.38531) [4.90551]	
C	-20017.62	
Error Correction:	D(CA)	D(ER)
CointEq1	-0.035592 (0.04359) [-0.81645]	-0.080021 (0.01606) [-4.98350]
D(CA(-1))	-0.223530 (0.11076) [-2.01818]	0.031845 (0.04080) [0.78060]
D(CA(-2))	-0.068696 (0.11002) [-0.62437]	-0.006159 (0.04053) [-0.15199]
D(CA(-3))	0.048445 (0.10975) [0.44140]	0.062872 (0.04043) [1.55525]
D(CA(-4))	0.237818 (0.11150) [2.13290]	0.106748 (0.04107) [2.59924]
D(CA(-5))	0.007323 (0.11140) [0.06574]	0.066576 (0.04103) [1.62251]
D(ER(-1))	0.596871 (0.25817) [2.31189]	-0.098600 (0.09509) [-1.03687]
D(ER(-2))	0.146600 (0.25106) [0.58393]	0.253728 (0.09247) [2.74380]
D(ER(-3))	0.182931 (0.25893) [0.70648]	-0.083780 (0.09537) [-0.87844]
D(ER(-4))	0.054846 (0.24918) [0.22010]	-0.333198 (0.09178) [-3.63030]
D(ER(-5))	0.064195 (0.26524) [0.24203]	-0.120972 (0.09770) [-1.23826]
C	-28.57639 (220.785) [-0.12943]	151.1372 (81.3223) [1.85850]
R-squared	0.172560	0.355687
Adj. R-squared	0.071429	0.276937
Sum sq. resids	4.07E+08	55222235
S.E. equation	2126.647	783.3137
F-statistic	1.706293	4.516693
Log likelihood	-919.9032	-818.0288
Akaike AIC	18.27261	16.27507
Schwarz SC	18.58143	16.58389
Mean dependent	89.08990	129.6227
S.D. dependent	2206.926	921.1870
Determinant resid covariance (dof adj.)		2.76E+12
Determinant resid covariance		2.15E+12
Log likelihood		-1737.691
Akaike information criterion		34.58218
Schwarz criterion		35.25129
Number of coefficients		26

IRF analysis will explain the impact of shocks in one variable on other variables, where in this analysis, it is not only in the short term but can be analyzed for several future horizons as long-term information. In this analysis, you can see the long-term dynamic response of each variable if there is a particular shock, which is one standard error in each equation. IRF analysis also functions to see how long the influence lasts. Following are the results of the impulse response function for 60 periods.

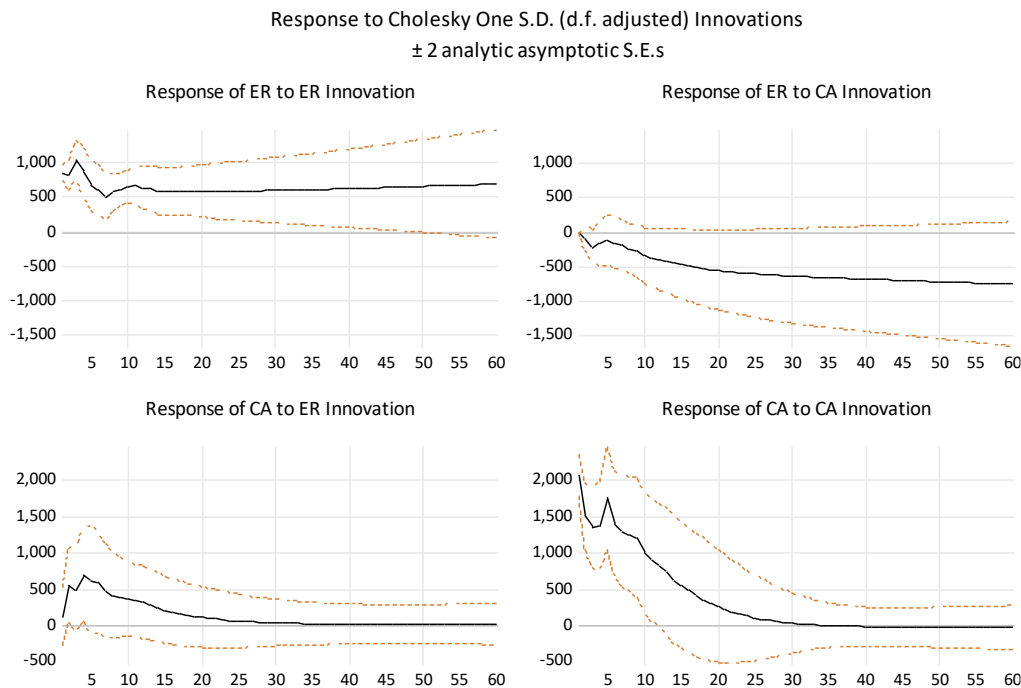


Figure 1. Response to Sholesky One S.D

If the exchange rate is given a shock of 1 standard deviation, the favorable exchange rate response increases by 866. For the next period, it continues to increase, but it decreases in several subsequent periods and tends to stabilize in the range of 500 from the 10 to 60 period. In period 1, the exchange rate response to the current account balance was not yet visible after the shock. After that, the response to the exchange rate decreased in the following few periods and even tended to respond negatively until it reached -800. Meanwhile, the current account balance's response to the positive exchange rate at the beginning of the period touched 500. However, it decreased in several subsequent periods and tended to stagnate at 0 in the 40 to 60. The same thing happens to the response of the current account balance to the current account balance itself. At the beginning of the period, it showed a positive reaction in 2000 and slowly decreased until it stabilized in the 0 range from 30 to 60.

Variance decomposition aims to measure the magnitude of each variable's contribution or composition of the influence on other variables. The following are the results of the variance decomposition rate of the current account balance and exchange rates for 60 periods.

Variance Decomposition using Cholesky (d.f. adjusted) Factors

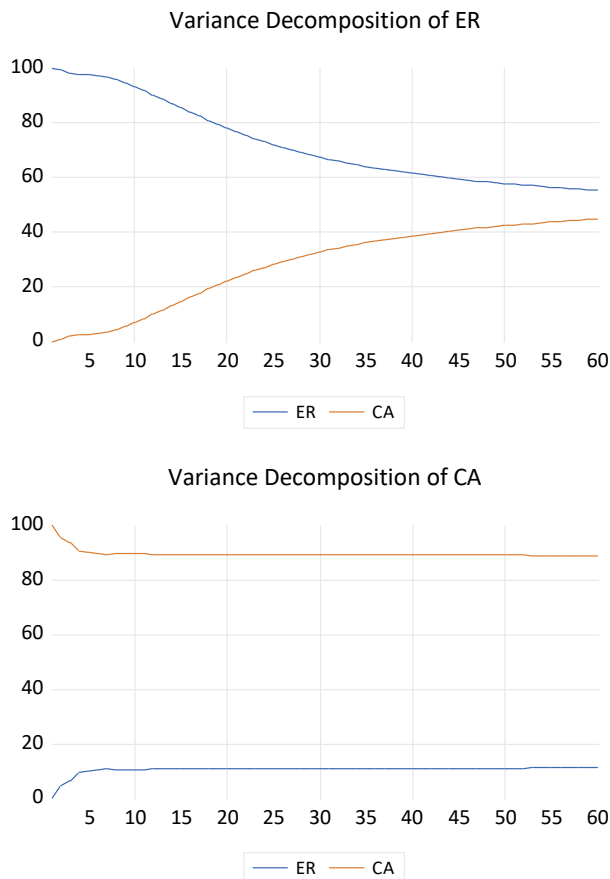


Figure 2. Variance Decomposition

In the initial period, the most significant variable contribution to the exchange rate was the exchange rate itself, but over time, the exchange rate variable decreased. Meanwhile, in the 30th period, the exchange rate was influenced by the increasing current account balance, not the exchange rate variable. On the other hand, it looks pretty stable for variables from the current account balance. It is still influenced and contributed by the current exchange rate variable itself after several periods.

Table 11. Variance Decomposition of ER.

Variance Decomposition of ER:			
Period	S.E.	ER	CA
1	864.3351	100.0000	0.000000
2	1205.403	99.48433	0.515670
3	1615.888	97.89222	2.107776
4	1848.113	97.58029	2.419714
5	1974.125	97.49802	2.501984
6	2075.494	97.08922	2.910785
7	2147.329	96.49475	3.505249
8	2239.163	95.65754	4.342457
9	2340.392	94.61036	5.389644
10	2456.540	93.19179	6.808214
11	2575.871	91.67256	8.327444
12	2686.341	90.14472	9.855282
13	2791.084	88.58983	11.41017
14	2888.986	86.99973	13.00027
15	2984.952	85.41271	14.58729
16	3081.092	83.84593	16.15407
17	3178.560	82.29920	17.70080
18	3277.519	80.79088	19.20912
19	3376.155	79.34086	20.65914
20	3473.924	77.95257	22.04743
21	3570.197	76.62533	23.37467
22	3665.068	75.36024	24.63976
23	3758.869	74.15974	25.84026
24	3851.902	73.02183	26.97817
25	3944.421	71.94531	28.05469
26	4036.375	70.92847	29.07153
27	4127.675	69.96878	30.03122
28	4218.217	69.06273	30.93727
29	4307.939	68.20696	31.79304
30	4396.861	67.39871	32.60129
31	4485.033	66.63517	33.36483
32	4572.531	65.91369	34.08631
33	4659.407	65.23176	34.76824
34	4745.692	64.58687	35.41313
35	4831.401	63.97656	36.02344
36	4916.544	63.39844	36.60156
37	5001.138	62.85033	37.14967
38	5085.204	62.33023	37.66977
39	5168.773	61.83630	38.16370
40	5251.874	61.36684	38.63316
41	5334.537	60.92029	39.07971
42	5416.786	60.49517	39.50483
43	5498.645	60.09010	39.90990
44	5580.131	59.70378	40.29622
45	5661.267	59.33503	40.66497
46	5742.070	58.98274	41.01726
47	5822.562	58.64592	41.35408
48	5902.762	58.32362	41.67638
49	5982.689	58.01498	41.98502
50	6062.362	57.71919	42.28081
51	6141.796	57.43551	42.56449
52	6221.007	57.16323	42.83677
53	6300.012	56.90172	43.09828
54	6378.825	56.65038	43.34962
55	6457.460	56.40863	43.59137
56	6535.932	56.17597	43.82403
57	6614.253	55.95192	44.04808
58	6692.436	55.73601	44.26399
59	6770.495	55.52784	44.47216
60	6848.440	55.32700	44.67300

Table 12. Variance Decomposition of CA

Variance Decomposition of CA: Period	S.E.	ER	CA
1	2074.468	0.411967	99.58803
2	2625.304	4.801003	95.19900
3	2997.289	6.482078	93.51792
4	3367.859	9.544369	90.45563
5	3847.161	9.879871	90.12013
6	4137.002	10.57064	89.42936
7	4360.969	10.69332	89.30668
8	4556.425	10.61742	89.38258
9	4732.087	10.51961	89.48039
10	4851.778	10.56049	89.43951
11	4946.703	10.63903	89.36097
12	5024.492	10.72244	89.27756
13	5085.697	10.78623	89.21377
14	5129.444	10.84733	89.15267
15	5163.244	10.87801	89.12199
16	5189.367	10.89966	89.10034
17	5208.868	10.91688	89.08312
18	5222.993	10.93634	89.06366
19	5233.683	10.95504	89.04496
20	5241.645	10.97291	89.02709
21	5247.440	10.98926	89.01074
22	5251.614	11.00317	88.99683
23	5254.671	11.01459	88.98541
24	5256.874	11.02425	88.97575
25	5258.442	11.03263	88.96737
26	5259.560	11.04012	88.95988
27	5260.363	11.04681	88.95319
28	5260.936	11.05285	88.94715
29	5261.344	11.05823	88.94177
30	5261.637	11.06299	88.93701
31	5261.850	11.06719	88.93281
32	5262.008	11.07092	88.92908
33	5262.129	11.07427	88.92573
34	5262.227	11.07730	88.92270
35	5262.311	11.08007	88.91993
36	5262.386	11.08262	88.91738
37	5262.457	11.08498	88.91502
38	5262.527	11.08717	88.91283
39	5262.597	11.08922	88.91078
40	5262.667	11.09115	88.90885
41	5262.740	11.09298	88.90702
42	5262.816	11.09473	88.90527
43	5262.894	11.09641	88.90359
44	5262.974	11.09804	88.90196
45	5263.057	11.09963	88.90037
46	5263.143	11.10118	88.89882
47	5263.230	11.10270	88.89730
48	5263.320	11.10420	88.89580
49	5263.412	11.10569	88.89431
50	5263.506	11.10716	88.89284
51	5263.602	11.10863	88.89137
52	5263.699	11.11009	88.88991
53	5263.798	11.11155	88.88845
54	5263.899	11.11301	88.88699
55	5264.001	11.11448	88.88552
56	5264.105	11.11595	88.88405
57	5264.209	11.11743	88.88257
58	5264.316	11.11891	88.88109
59	5264.423	11.12041	88.87959
60	5264.532	11.12192	88.87808

The output results show that the current account balance variable influences the fluctuating exchange rate variable. The exchange rate declined from the first period to the 60th period (100.0000-55.32700), while the current account balance increased from the first period to the 60th period (0.00000-44.67300).

5. Conclusion

This research finds weak evidence of a J-curve effect on the current account balance in Indonesia because empirical results with several tests and models reject the J-curve hypothesis and do not find evidence of an influence of the rupiah exchange rate on Indonesia's current account balance in the long term so that it can the conclusion is drawn that: (1) There is no causal relationship between the current account balance and the exchange rate in Indonesia from 1996-2022; (2) Changes in exchange rates affect changes in the current account balance

in the short and long term; (3) The mechanism for changes in the current account deficit does not affect changes in the exchange rate. Based on the empirical findings in this research, it is recommended that the government implement policies to encourage exports and control imports to correct the current account deficit. This should not be done solely with actions aimed at encouraging or allowing the depreciation of the rupiah without being accompanied by policies to improve internal conditions (real sector) in Indonesia. A consequence of the floating exchange rate policy, which cannot be denied, has created economic difficulties for domestic production activities; it has been proven that exchange rate fluctuations are not profitable for exports, and the monetary authority needs to continue to pay more attention to policies to maintain and control the stability of the rupiah exchange rate. This will encourage the country's real sector (production) and provide business certainty for Indonesian exporters. For the development of subsequent studies, it is crucial to delve deeper into the J-curve theory and the assumptions used, considering the conditions in different countries. This research, which considers the exchange rate as a minor factor based on the standard J-curve theory, suggests that future studies could explore the inclusion of other variables or proxies to explain current transaction behavior. The strategy that can be taken is to stabilize the Indonesian rupiah exchange rate, which not only relies on the supply of dollars in the money market but also maintains a current account surplus. The government can also improve the performance of the Indonesian economy, which has collapsed due to the multidimensional crisis.

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