



Foreign exchange reserves dynamics: Trade balance and external debt in an ecm analysis

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ABSTRACT

This study examines the dynamics of foreign exchange reserves within an open economy framework by focusing on the roles of trade balance and external debt. In recent years, the stability of foreign exchange reserves has become a critical issue due to increasing external volatility, global economic uncertainty, and growing dependence on international trade and financial flows. This study aims to analyze both short-run and long-run relationships between trade balance, external debt, and foreign exchange reserves. The research employs an Error Correction Model (ECM) using quarterly data from 2016 to 2025. The results indicate that the trade balance has no significant effect in the short run but exhibits a positive and significant effect in the long run on foreign exchange reserves. In contrast, external debt has a positive and significant impact in both the short run and long run. These findings suggest that foreign exchange reserves are influenced by a dynamic adjustment mechanism, where the real sector plays a dominant role in the long run, while the financial sector contributes more rapidly in the short run. The main contribution of this study lies in highlighting the asymmetric relationship between external sector variables and foreign exchange reserves, emphasizing the importance of adjustment processes toward long-run equilibrium. These findings are important for policy formulation aimed at maintaining foreign reserve stability through export strengthening, value-added improvement, and sustainable external debt management.

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1. INTRODUCTION

In recent decades, the global economy has undergone significant transformation alongside the advancement of globalization and the liberalization of international trade. These conditions require every country to possess economic instruments capable of maintaining the stability of the external sector, particularly in the face of global trade dynamics and capital flows. In this case, foreign exchange reserves have become a key

indicator reflecting a country's economic resilience while also serving as a pillar of macroeconomic stability (Yossinomita, 2024).

Foreign exchange reserves are one of the key indicators reflecting a country's external sector resilience and its capacity to withstand global economic pressures. In an open economy, foreign exchange reserves serve two primary functions: as a source of financing during balance of payments deficits and as a tool for maintaining exchange rate stability (Marethasya Fortuna et al., 2021). Foreign exchange reserves refer to the accumulation of foreign currency held by a country. The larger the foreign exchange reserves, the greater the country's capacity to conduct economic and financial transactions at the international level (Tampubolon, 2020). Additionally, foreign exchange reserves serve as the primary source of financing to support international trade activities. In Indonesia, foreign exchange reserves are recorded in the balance of payments and managed by the monetary authority, in this case Bank Indonesia, and can be utilized at any time as needed.

The trade balance is one of the key factors determining the stability of a country's foreign exchange reserves and its economic resilience. A sustained trade surplus not only increases foreign exchange reserves but also enhances the government's ability to maintain the stability of the rupiah exchange rate and meet foreign payment obligations. Therefore, maintaining a balance between exports and imports through effective trade policies is crucial for strengthening Indonesia's foreign exchange reserve position amid the dynamics of the global economy. The Mundell-Fleming theory emphasizes the interrelationship between the balance of payments and capital flows in open economy. This theory explains the mechanism by which the trade balance and external debt influence foreign exchange reserves, both in the short term and during the long-term adjustment process toward a new equilibrium (N. Gregory Mankiw, 2015).

In addition to the trade balance, foreign debt plays a significant role in the formation and use of foreign exchange reserves, particularly in developing countries facing constraints on domestic financing sources. These loans are obtained from foreign sources and must be repaid in accordance with agreed-upon terms (Subagiyo & Budiman, 2020). Foreign debt can serve as a source of development financing, but at the same time creates repayment obligations that could potentially deplete foreign exchange reserves if not managed sustainably (Todaro & Smith, 2011). Foreign debt has a significant relationship with foreign exchange reserves, reflecting the complex interplay between external financing and a country's international liquidity position (Savira, 2024).

In early 2024, Indonesia's foreign exchange reserves were recorded to have declined to approximately US\$144 billion in February 2024, lower than the previous month. This decline was primarily driven by the government's maturing external debt obligations and other external financing needs. This phenomenon has become a significant issue because foreign exchange reserves are supposed to serve as an economic buffer, yet they have actually decreased due to the ever-increasing burden of external obligations (Simanjuntak, 2024). In December 2024, foreign exchange reserves did rise to US\$155.7 billion, but this increase was largely driven by short-term factors such as tax revenue, foreign loan disbursements, and oil and gas revenue. This means that the strengthening of foreign exchange reserves remains heavily dependent on capital inflows and foreign debt, rather than solely on sustainable export performance. Based on the description of empirical phenomena and the discrepancy between theory and reality, research on "The Effect of the Trade Balance and Foreign Debt on Indonesia's Foreign Exchange Reserves 2016–2025" is essential. This research is expected to provide a clearer picture of the factors influencing Indonesia's foreign exchange reserves and serve as a consideration in formulating macroeconomic policies.

The relationship between macroeconomic variables is often not instantaneous but occurs through an adjustment process toward long-run equilibrium. Several previous studies have discussed the relationship between the trade balance, external debt, and

foreign exchange reserves. However, several limitations remain, indicating a research gap. Based on this gap, the novelty of this study lies in the simultaneous analysis of the influence of the trade balance and external debt on Indonesia's foreign exchange reserves, using the latest quarterly data up to 2025, and the application of the Error Correction Model (ECM) to capture the dynamics of short-term adjustments and long-term equilibrium. (Gujarati & Porter, 2012) explain that dynamic econometric models such as the Error Correction Model (ECM) allow researchers to identify cointegration relationships and the speed of adjustment toward that equilibrium. With this ECM approach, the research is expected to provide a more comprehensive picture of the mechanism of the external sector's influence on Indonesia's foreign exchange reserves in the constantly changing global economic conditions

Based on this background, this study aims to analyze the relationship between long-run equilibrium and short-run adjustment mechanisms of Indonesia's foreign exchange reserves using the Error Correction Model approach, while considering the roles of the trade balance and external debt

2. RESEARCH METHOD

This study employs a quantitative approach. The data used in this study consists of quarterly time-series data, spanning from the first quarter of 2016 to the third quarter of 2025. The 2016–2025 period is an interesting one to study because it is characterized by various economic dynamics, such as fluctuations in global commodity prices, global economic uncertainty, the COVID-19 pandemic, and increased financing needs through foreign debt. These conditions have caused Indonesia's foreign exchange reserves to become more volatile and not always in line with changes in the trade balance or foreign debt. Given this timeframe, the total number of data observations used in this study is 39. This period was chosen based on the availability and consistency of data for all research variables and to represent the latest developments in Indonesia's external sector. The use of quarterly data allows for a more detailed analysis of the short- and long-term dynamics of the trade balance, external debt, and foreign exchange reserves. The data sources in this study consist of secondary data obtained from Bank Indonesia and the Indonesian Central Statistics Agency (BPS). The independent variables are the trade balance and foreign debt, while the dependent variable is foreign exchange reserves.

The analytical method used in this study is the Error Correction Model (ECM). The Error Correction Model (ECM) is used to analyze the variables that influence foreign exchange reserves in Indonesia. The ECM is used to determine whether independent variables affect the dependent variable in the short term or the long term. The analytical tool used to process the data in this study is Eviews 12.

3. RESULTS AND DISCUSSIONS

3.1 Research Results

The analysis method used in this study is the Error Correction Model (ECM). The use of the ECM method involves several testing stages, including:

3.2 Unit Root Test

This test aims to analyze whether the time series data is stationary or non-stationary. The ECM analysis technique requires that the variables used be non-stationary at the level. If the data being tested is non-stationary at the level, proceed to the next testing stage until all variables are stationary at the first-difference level. The unit root test in this study uses the Dickey-Fuller (ADF) test, with the stipulation that a

variable is deemed non-stationary if its probability is greater than the significance level (0.05).

Table 1. Results of the Unit Root Test at the Level

Variabel	Prob*
Foreign Exchange Reserves	0.4050
Trade Balance	0.5871
External Debt	0.3635

Source: Processed data

Based on the results of the Root Test, the probability values for all variables were greater than the 5% significance level ($\alpha = 0.05$). This indicates that the variables of foreign exchange reserves, trade balance, and foreign debt are non-stationary at their original levels. Therefore, further testing at the first-difference level is required.

Table 2. Results of the Root Test at the first-difference level

Variabel	Prob*
D(Cadangan Devisa)	0.0000
D(Trade Balance)	0.0000
D(External Debt)	0.0000

Source: Processed data

Based on the results of the stationarity test at the first-difference level, the probability value for all variables was 0.0000 (<0.05). This means that all variables are stationary at the first-difference level, so the analysis can proceed to the next stage.

3.3 Long-Run Estimation Test

This estimation uses the Ordinary Least Squares (OLS) method with all variables in their original form or at their observed levels. The results of the long-run estimation are presented in Table 3.

Tabel 3. Long-Run Estimation Results

Variabel	Coefficient	t-statistic	Prob
Trade Balance	2.03	2.89	0.0064
Foreign Debt	0.29	8.82	0.0000
C	13.09	1.05	0.2965
R-squared	0.805947		
Adjusted R-squared	0.795166		
F-statistic	74.75800		
Prob(F-statistic)	0.000000		

Source: processed data

Based on the long-term estimation results, the following long-term model was obtained:

$$Y = 13.09 + 2.03X_{1t} + 0.29X_{2t} + e_t \quad (1)$$

Referring to Table 3, the trade balance and foreign debt variables have a positive and significant effect on foreign exchange reserves. This is indicated by the probability values of 0.0064 for the trade balance and 0.0000 for foreign debt (), both of which are less than 0.05. The trade balance coefficient of 2.033094 indicates that a one-unit increase in the trade balance will increase foreign exchange reserves by 2.033094 units, while the foreign debt coefficient of 0.295427 means that every one-unit increase in foreign debt will increase foreign exchange reserves by 0.295427 units. Furthermore, the Prob (F- statistic) value of 0.000000 indicates that all independent variables simultaneously have a significant effect on foreign exchange reserves, with the model

explaining 79.51% of the variation in foreign exchange reserves based on the Adjusted R-Squared value.

3.4 Cointegration Test

The cointegration test is used to provide an initial indication of whether the model in the study has a long-term relationship (cointegration). If there is no cointegration, it means there is no long-term relationship. This test is conducted using the Augmented Dickey- Fuller test.

Tabel 4. Cointegration Test Estimation Results

Cointegration Test Estimation Results	t-Statistic	Prob
Augmented Dickey-Fuller test statistic	-3.08	0.0359
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

Source: Processed data

The cointegration results show that the absolute ADF residual value of 0.0359 is less than 0.05. This indicates that the residuals are stationary at the level and suggests that all variables are cointegrated. The negative ADF statistic compared to the 5% critical value (-2.941145) indicates that the residuals (ECT) are stationary, meaning the variables in the model are cointegrated and have a long-run relationship, and the model does not include spurious regression. Thus, the data meets the requirements for further analysis using the Error Correction Model (ECM) to examine short-term relationships and the adjustment process toward long-term equilibrium.

3.5 Error Correction Model (ECM) Analysis

Table 5. Short-Term Model Estimation Results

Variabel	Coefficient	t-statistic	Prob
D(Trade Balance)	0.01	0.02	0.9829
D(Foreign Debt)	0.50	6.40	0.0000
ECT(-1)	-0.30	-2.71	0.0104
C	-0.36	-0.51	0.6072
R-squared	0.5907		
Adjusted R-squared	0.5545		
F-statistic	16.3570		
Prob(F-statistic)	0.000001		

Source: Processed data

Based on the results of the short-run equation estimation, the model derived from the variables Foreign Exchange Reserves, Trade Balance, and Foreign Debt is as follows:

$$Y = -0.36 + 0.01X_{1t} + 0.50X_{2t} - 0.30ECT_{t-1} + e_t \quad (2)$$

Based on the results of the Error Correction Model (ECM) estimation, it was found that in the short term, the trade balance variable does not have a significant effect on foreign exchange reserves, as indicated by a probability value of 0.9829, which is greater than 0.05; thus, changes in the trade balance cannot directly explain changes in foreign exchange reserves. Conversely, the foreign debt variable has a positive and significant effect on foreign exchange reserves with a coefficient of 0.50 and a probability of 0.0000, meaning that every increase in foreign debt tends to increase foreign exchange reserves in the short term. The ECT (-1) coefficient value of -0.306316 with a probability of 0.0104 shows a negative and significant sign, indicating that approximately 30.63% of the short-term imbalance will be corrected toward long-term equilibrium in the subsequent period, thus proving the existence of a long-term relationship among the variables. Thus, the

ECM model used meets statistical criteria and is suitable for explaining the relationship between the trade balance, foreign debt, and foreign exchange reserves in Indonesia.

Furthermore, the Prob (F-statistic) value of 0.000001 indicates that, taken together, all independent variables have a significant effect on foreign exchange reserves, while the Adjusted R-Squared value of 0.554599 indicates that approximately 55.45% of the variation in foreign exchange reserves can be explained by the variables in the model, with the remainder influenced by other factors outside the scope of this study. Thus, the ECM model used meets statistical criteria and is suitable for explaining the relationship between the trade balance, external debt, and foreign exchange reserves in Indonesia.

3.6 Discussion

The results of this study indicate that the dynamics of Indonesia's foreign exchange reserves cannot be explained in isolation but rather result from the interaction between the real sector as reflected in the trade balance and the external financial sector as represented by external debt where both play distinct roles in the short and long term within an open economy framework. Foreign exchange reserves not only reflect the magnitude of foreign currency inflows but also indicate a country's ability to adjust to dynamically occurring external imbalances. In this context, the use of the Error Correction Model (ECM) approach is relevant because it captures both short-term relationships and the adjustment mechanisms toward long-term equilibrium (Gujarati & Porter, 2012). The static model approach has limitations in capturing dynamic economic adjustment mechanisms, making the Error Correction Model (ECM) approach more relevant for simultaneously analyzing short-run and long-run relationships (Sihombing et al., 2026).

In the short term, the estimation results indicate that the trade balance does not have a significant effect on foreign exchange reserves, even though the resulting coefficient is positive. This finding suggests that changes in the trade balance are not directly reflected in changes in foreign exchange reserves over the same period. Empirically, this condition is closely related to Indonesia's trade structure, which remains dominated by imports of capital goods and raw materials. Increases in exports are often followed by increases in imports to support production activities, so the net impact on foreign exchange reserves remains relatively limited in the short term (Nurcayah, 2022).

Furthermore, the process of receiving foreign exchange from export activities does not occur instantly but rather through international payment mechanisms that involve a certain time lag. Consequently, there is a time lag between trade activities and the inflow of foreign exchange into the country's reserves. This lag phenomenon is a common characteristic of relationships between macroeconomic variables, in which the transmission of effects does not occur simultaneously but through cross-period adjustment processes (Naima et al., 2025). This is also consistent with the concept of the lead-lag effect in economics, which indicates that causal relationships between economic variables are delayed and influenced by market mechanisms and financial institutions. This explains why, in the short term, the trade balance has not yet been able to serve as the primary determinant of foreign exchange reserves. In other words, the impact of the trade balance on foreign exchange reserves is indirect and requires a gradual transmission process.

These findings are consistent with various previous empirical studies showing that, in the short term, foreign exchange reserves are more sensitive to financial sector variables than to real sector variables. Studies using the ECM approach indicate that monetary variables such as exchange rates and interest rates have a stronger influence on foreign exchange reserves in the short term compared to trade- e variables (Sihombing et al., 2026). This confirms that, in the short term, foreign exchange reserves are more influenced by the dynamics of global financial markets and international capital flows.

Nevertheless, the significance of the Error Correction Term (ECT) in this study indicates that the economic system possesses an adjustment mechanism for short-term imbalances. An ECT value of -0.306316 indicates that approximately 30.63% of the deviation from long-term equilibrium will be corrected within one period. This suggests that although the trade balance does not have a direct impact in the short term, the economic system continues to move toward equilibrium through a gradual adjustment process. From this perspective, foreign exchange reserves not only reflect actual conditions but also reflect expectations and the economy's adjustment process to external changes (Naima et al., 2025). Thus, the presence of a significant ECT confirms that the relationship between variables in the model is cointegrative and not spurious.

In contrast to the short term, long-term estimation results indicate that the trade balance has a positive and significant effect on foreign exchange reserves. This finding confirms that a sustained trade surplus is the primary source of foreign exchange reserve accumulation. Within the framework of balance of payments theory, a current account surplus increases foreign exchange reserves through foreign currency inflows from exports (Hery, 2022). Furthermore, in the Mundell-Fleming model, the external sector plays a crucial role in determining macroeconomic equilibrium in an open economy, making trade performance a key factor in the formation of foreign exchange reserves.

This finding is supported by various empirical studies showing that exports have a positive impact on foreign exchange reserves (Puspita Sari et al., 2024) and serve as a key determinant in enhancing the external resilience of developing countries (Delvia et al., 2025). Thus, the trade balance functions not only as an indicator of the real sector's performance but also as a sustainable source of foreign exchange. From a broader perspective, a trade surplus reflects the competitiveness of the national economy and a country's ability to reduce its reliance on external financing.

Furthermore, these findings can be explained through the precautionary motive and buffer stock theories, according to which countries tend to increase their foreign exchange reserves as a form of protection against external uncertainty. In a volatile global environment, foreign exchange reserves serve as a stabilization tool that enables countries to maintain exchange rates, meet external obligations, and mitigate the risk of economic crises. Therefore, a trade surplus not only directly increases foreign exchange reserves but also strengthens overall economic stability.

Compared to previous research, these results are consistent with various studies that found the trade balance to have a significant impact in the long run but not in the short run, such as (Ratnasari et al., 2017), (Dwinoviyanto et al., 2023), (Restanti, 2022) and (Bake et al., 2024). However, this study makes an additional contribution by confirming that this relationship is not only long-term but also involves measurable adjustment mechanisms. Thus, this study enriches the literature by demonstrating that the impact of the trade balance on foreign exchange reserves is dynamic and cannot be understood statically.

Beyond confirming previous empirical findings, this study contributes to the development of the ECM literature on Indonesia's external sector in several ways. First, it extends the application of the ECM framework by simultaneously examining the roles of trade balance and external debt as representations of the real sector and financial sector within a unified adjustment mechanism. While previous studies generally focused on identifying the significance of individual variables, this study emphasizes how different external sector variables contribute through distinct adjustment pathways toward long-run equilibrium. Second, this study provides empirical evidence that foreign exchange reserve accumulation in Indonesia is characterized by heterogeneous adjustment dynamics. The results reveal that the trade balance primarily acts as a long-run structural determinant, whereas external debt functions as both a short-run liquidity source and a long-run contributor to reserve accumulation. This distinction enriches the ECM literature by demonstrating that the relationship between external sector variables

and foreign exchange reserves is not uniform across time horizons. Third, by employing quarterly data covering the period 2016–2025, which includes major economic events such as the COVID-19 pandemic and the post-pandemic recovery period, this study provides updated empirical evidence regarding the resilience and adjustment mechanisms of Indonesia's external sector. Therefore, the contribution of this study lies not only in identifying long-run cointegration relationships but also in explaining how different external sector variables interact through a measurable adjustment process toward equilibrium.

Recent empirical evidence supports these findings. In November 2024, Indonesia recorded a trade surplus of USD 4.42 billion, yet the rupiah exchange rate remained under pressure due to global sentiment. This suggests that in the short term, external factors such as global monetary policy and international capital flows may be more dominant than trade fundamentals. However, in the long term, the trade surplus continues to contribute to an increase in foreign exchange reserves, which reached USD 152.6 billion in 2025 (Hailat et al., 2023). In line with this, Agustina, emphasizes that the trade balance is part of a stable long-term external equilibrium, although short-term dynamics are heavily influenced by economic structure and external factors (Agustina et al., 2025).

These findings indicate that the relationship between the trade balance and foreign exchange reserves is nonlinear and influenced by other external factors. Thus, it can be concluded that the trade balance is a long-term structural determinant, rather than a direct short-term determinant. On the other hand, the research findings indicate that foreign debt has a positive and significant impact on foreign exchange reserves in both the short and long term. In the short term, this suggests that foreign debt serves as a rapid source of external liquidity, as loan proceeds received in foreign currency directly increase foreign exchange reserves. This finding aligns with research showing that capital inflows, including foreign debt, make a significant contribution to foreign exchange reserves (Tirtana et al., 2025).

However, the role of foreign debt cannot be viewed one-sidedly as an entirely positive factor. From a more comprehensive perspective, foreign debt has a dual nature. On the one hand, foreign debt increases foreign exchange reserves in the short term, but on the other hand, it creates payment obligations that have the potential to reduce foreign exchange reserves in the future. This is consistent with empirical findings showing that foreign debt can increase foreign exchange reserves, but can also become a source of pressure on foreign exchange reserves if not managed properly (Nurrohm et al., 2025).

In the long term, the positive impact of foreign debt on foreign exchange reserves persists, indicating that capital inflows remain one of the primary sources of foreign exchange reserve accumulation. However, these results also indicate that a portion of the foreign exchange reserves formed does not entirely stem from the strength of the real sector, but rather from external financing. Thus, the increase in foreign exchange reserves derived from foreign debt must be interpreted with caution, as it does not fully reflect the fundamental strength of the domestic economy.

Empirical evidence from Indonesia indicates that although the external debt ratio is relatively under control, debt repayment obligations continue to put pressure on foreign exchange reserves, particularly during maturity periods. This suggests that the sustainability of external debt is a key factor in maintaining the stability of foreign exchange reserves. Baksay et al. demonstrate that while external debt can increase foreign exchange reserves through foreign currency inflows, debt repayment obligations in subsequent periods can actually reduce foreign exchange reserves and create liquidity pressures (Baksay et al., 2012). Therefore, prudent management of external debt oriented toward productive financing is key to minimizing risks to foreign exchange reserves. Furthermore, Waheed and Abbas emphasize that the sustainability of foreign debt is a

key element in maintaining a country's macroeconomic stability and external position (Waheed & Abbas, 2021). In the context of developing countries, including Indonesia, foreign debt is indeed an important source of financing; however, without proper management, it can become a burden that undermines economic stability (Feriyanto et al., 2025).

Furthermore, the results of the simultaneous tests indicate that the trade balance and external debt together have a significant impact on foreign exchange reserves in both the short and long term. In the short term, this effect reflects a combination of foreign exchange flows from trade and external financing that directly affect the foreign exchange reserve position (Aritonang et al., 2020). Meanwhile, in the long term, the interaction between the real and financial sectors becomes increasingly important in determining the stability of foreign exchange reserves.

These findings are consistent with previous research indicating that foreign exchange reserves result from the interaction between international trade and capital flows (Rahmawati & Suriani, 2022). However, this study offers a more in-depth contribution by demonstrating that this relationship is not only simultaneous but also dynamic, operating through adjustment mechanisms toward long-term equilibrium.

The asymmetric relationship identified in this study has important implications for both foreign exchange reserve management and external sector policy. The findings indicate that foreign exchange reserves are supported by two different mechanisms. In the short run, reserve accumulation is more responsive to external financing through foreign debt because debt inflows provide immediate foreign currency liquidity. However, this source of reserve accumulation may be vulnerable to future repayment obligations and changes in global financial conditions (Khusnatun & Hutajulu, 2021). Consequently, foreign exchange reserves generated through external borrowing may enhance liquidity but do not necessarily reflect improvements in the productive capacity of the domestic economy (Mohd Daud & Podivinsky, 2011).

In contrast, the long-run significance of the trade balance suggests that sustainable foreign exchange reserve accumulation depends primarily on the country's ability to generate foreign exchange through export activities. This implies that reserve adequacy based on trade performance is structurally stronger and less vulnerable to external financing shocks than reserve accumulation driven by debt inflows. Therefore, the asymmetrical relationship found in this study indicates that policymakers should not interpret increases in foreign exchange reserves solely as a sign of improved external sector performance. Instead, attention should be directed toward the composition of reserve sources, since reserves derived from export earnings and reserves derived from debt inflows have different implications for long-term economic resilience.

Overall, the results of this study confirm that the relationship between the trade balance, external debt, and foreign exchange reserves is asymmetric between the short term and the long term. In the short term, foreign exchange reserves are more influenced by liquidity factors and capital flows, whereas in the long term they are more determined by the performance of the real sector. Thus, the stability of foreign exchange reserves cannot be achieved solely through increased external financing, but requires the strengthening of the economic structure through improved export competitiveness, industrial downstreaming, and sustainable management of external debt. This finding also underscores that foreign exchange reserves serve as a strategic indicator reflecting the integration between the trade sector and the financial sector within an open economy. Therefore, economic policies aimed at ensuring the stability of foreign exchange reserves must strike a balance between strengthening the real sector through exports and managing the financial sector through foreign debt in a prudent and sustainable manner.

4. CONCLUSION

The dynamics of foreign exchange reserves are not only determined by the amount of foreign exchange inflows, but are more influenced by the economic adjustment mechanism to external sector imbalances. The trade balance proves to have no significant influence in the short term, but plays an important role in shaping foreign exchange reserves in the long term. This shows that the contribution of the trade sector to foreign exchange reserves requires a continuous accumulation process. In contrast, external debt has a positive and significant effect in both the short and long term, indicating that external financing acts as a source of quick foreign exchange liquidity. However, the effect is not permanent because it is followed by payment obligations that trigger an adjustment mechanism towards long-term equilibrium. This finding confirms that the relationship between external sector variables and foreign exchange reserves is asymmetric between the short and long run and involves a dynamic adjustment process.

Simultaneously, the trade balance and foreign debt have a significant effect on foreign exchange reserves in both the short and long term, indicating that the stability of foreign exchange reserves is the result of the interaction between the real sector and the financial sector. Thus, foreign exchange reserves cannot be explained partially, but must be understood as the result of an integrated open economic system.

From a policy perspective, these findings suggest the importance of balancing short-term liquidity management with long-term export development strategies. While external debt may remain an important instrument for supporting reserve adequacy during periods of economic uncertainty, long-term reserve sustainability ultimately depends on strengthening export competitiveness, expanding value-added industries, and reducing excessive dependence on external financing.

Furthermore, given the asymmetric effects identified in this study, further research could employ nonlinear models such as the Nonlinear ARDL (NARDL) model, which could provide deeper insights into the potential asymmetric response of foreign exchange reserves to positive and negative changes in the trade balance and external debt.

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