

Exchange Rate Depreciation in Indonesia: Trade Competitiveness, Corporate Vulnerability, and the Role of the Dominant Currency Paradigm

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Abstract

Exchange rate fluctuations significantly impact the economic performance of emerging economies, particularly those heavily reliant on international trade. This study examines the influence of exchange rate movements on Indonesia's exports, imports, and investment through three transmission mechanisms: the trade channel, the balance sheet channel, and the Dominant Currency Paradigm (DCP). The analysis employs a combination of AutoRegressive Distributed Lag (ARDL), Nonlinear AutoRegressive Distributed Lag (NARDL), panel data regression, and sectoral estimation approaches utilizing quarterly macroeconomic data and firm-level financial data. The results from the trade channel analysis indicate that exchange rate depreciation positively contributes to export performance while reducing import demand in the long term. The nonlinear estimation further reveals significant asymmetry, demonstrating that depreciation exerts a stronger influence on trade flows than appreciation. A 1% depreciation of the real exchange rate is estimated to increase exports by approximately 0.85% and reduce imports by around 0.65%, resulting in an improvement in net exports. The balance sheet analysis demonstrates that exchange rate depreciation can adversely affect corporate investment by increasing the burden of foreign currency-denominated liabilities. However, the magnitude of this effect varies depending on firms' exposure to foreign currency debt. The sectoral analysis confirms substantial heterogeneity across industries, where sectors with higher foreign currency liabilities experience larger investment contractions following depreciation, while sectors with lower exposure tend to benefit from improved competitiveness. Furthermore, the findings support the relevance of the Dominant Currency Paradigm, indicating that movements in the US dollar exchange rate play a more influential role in determining Indonesia's export performance than bilateral exchange rates with individual trading partners. The study concludes that exchange rate depreciation enhances Indonesia's external competitiveness and trade balance, albeit potentially creating financial vulnerabilities through the balance sheet channel. These findings underscore the significance of maintaining exchange rate stability, fortifying foreign currency risk management, and implementing policies that bolster both export competitiveness and corporate resilience to external shocks.

Keywords: exchange rate, export, import, balance sheet channel, dominant currency paradigm, ARDL, NARDL

1. Introduction

Exchange rate stability has become one of the most crucial determinants of export performance in developing countries, particularly in economies that rely heavily on international trade, such as Indonesia. In an increasingly integrated global economy, fluctuations in exchange rates influence not only trade competitiveness but also investment decisions, production capacity, and macroeconomic stability. For Indonesia, whose export structure is strongly connected to the commodity and manufacturing sectors, movements in the Rupiah exchange rate against

major foreign currencies, especially the US dollar, play a strategic role in determining export growth and external sector resilience.

Theoretically, exchange rate movements affect export performance through the trade channel. According to the traditional elasticity approach, a depreciation of the domestic currency lowers export prices in foreign markets, thereby increasing international demand for domestic goods and improving export competitiveness (Krugman & Obstfeld, 2009). Conversely, an appreciation of the exchange rate raises export prices, weakens competitiveness, and potentially reduces export demand. This mechanism positions exchange rates as one of the primary macroeconomic variables influencing export dynamics and economic growth.

In the Indonesian context, exchange rate movements have become increasingly significant due to the country's dependence on global trade transactions denominated in US dollars. Although Indonesia's bilateral trade with the United States represents only a portion of total trade flows, most international trade transactions are still invoiced in US dollars. This condition reflects the Dominant Currency Paradigm (DCP), introduced by Gopinath (2015; 2020), which explains that international trade prices are predominantly denominated in a dominant global currency rather than in the exporter's or importer's domestic currency. Consequently, fluctuations in the US dollar exchange rate strongly influence export prices, trade volumes, and overall external sector performance in emerging economies, including Indonesia.

Empirical evidence suggests that exchange rate depreciation may stimulate export growth by increasing the competitiveness of domestic products in international markets. Studies conducted by Bahmani-Oskooee and Hegerty (2010), Ahmed et al. (2017), and Boz et al. (2020) demonstrate that exchange rate depreciation tends to improve export performance, particularly in developing economies with export-oriented sectors. Similarly, research on Asian economies indicates that exchange rate adjustments significantly influence trade balance dynamics and export expansion (Kohler et al., 2014).

Several studies focusing on Indonesia also confirm the importance of exchange rates in shaping export performance. Husman (2005) found that depreciation of the Rupiah improved Indonesia's bilateral trade balance with major trading partners. Matitaputty (2018) revealed that exchange rate movements significantly affected Indonesia's export growth in both the short and long run. Furthermore, Fitriani (2017) and Suselo et al. (2008) emphasized that exchange rate volatility can negatively affect export performance because uncertainty in currency values increases transaction risks and discourages international trade activities.

However, despite the growing body of literature, several important gaps remain. First, many previous studies analyze exchange rate effects only at the aggregate level without considering differences across export commodities and trading partners. Indonesia's export structure is highly diverse, ranging from natural resources and agricultural commodities to manufactured goods. Consequently, exchange rate movements may generate heterogeneous impacts across sectors. Commodity-based exports such as coal, palm oil, and rubber may respond differently to exchange rate fluctuations compared to manufacturing exports such as textiles, electronics, and automotive products. Second, most previous studies employ linear models that assume

exchange rate appreciation and depreciation have symmetrical effects on exports. In practice, exchange rate movements often create asymmetric responses. Depreciation may stimulate exports more strongly than appreciation suppresses them, or vice versa. Bahmani-Oskooee et al. (2016) and Bahmani-Oskooee & Baek (2016) demonstrate that nonlinear exchange rate models provide more accurate explanations of trade behavior because export responses differ during periods of depreciation and appreciation. In Indonesia, studies using nonlinear approaches remain relatively limited and are mostly concentrated on specific sectors such as agriculture (Lestari et al., 2021).

In addition to trade competitiveness, exchange rate fluctuations also influence exports through corporate financial conditions and production capacity. Depreciation of the Rupiah increases the burden of foreign currency denominated debt held by domestic firms, particularly companies that depend heavily on imported raw materials or external financing. According to the balance sheet channel theory proposed by Bernanke et al. (1999), deteriorating corporate balance sheets may reduce firms' investment capacity and weaken production performance. For export-oriented companies, however, exchange rate depreciation may simultaneously increase export revenues and improve profitability, especially when export earnings are denominated in US dollars.

Another important issue is the increasing dominance of the US dollar in global trade invoicing. Studies by Gopinath (2016), Casas et al. (2017), and Boz et al. (2020) reveal that trade flows in developing countries are more sensitive to movements in the US dollar than to bilateral exchange rates with trading partners. This phenomenon suggests that depreciation of the Rupiah against the US dollar may exert stronger effects on Indonesia's export volume compared to depreciation against other currencies. Such conditions become highly relevant for Indonesia because the country's export transactions remain heavily dependent on dollar invoicing.

From a policy perspective, understanding the relationship between exchange rates and exports is highly important for maintaining Indonesia's external sector stability. Exchange rate depreciation may improve export competitiveness, but excessive depreciation can also increase inflationary pressures, production costs, and debt burdens. Therefore, policymakers need comprehensive empirical evidence regarding the extent to which exchange rate movements affect Indonesia's exports, both at the aggregate and commodity levels.

Based on these considerations, this study aims to analyze the impact of exchange rate fluctuations on Indonesia's export performance. Specifically, this research seeks to: examine the influence of Rupiah exchange rate movements on Indonesia's export volume, investigate the asymmetric effects of exchange rate depreciation and appreciation on exports, analyze exchange rate impacts across major export commodities and trading partners; and evaluate the relevance of the Dominant Currency Paradigm (DCP) in Indonesia's export activities.

This study contributes to the literature in several ways. First, it provides a more comprehensive analysis by combining aggregate and commodity-level export data. Second, this research applies both linear and nonlinear approaches to capture potential asymmetric exchange rate effects. Third, the study emphasizes the role of US dollar dominance in Indonesia's export

performance, an issue that has become increasingly relevant in the contemporary global trading system. Finally, this research is expected to provide practical insights for policymakers in designing exchange rate and trade policies aimed at strengthening Indonesia's export competitiveness and economic resilience.

2. Literature Review

Trade Channel. In international economics theory, the trade channel is one of the primary mechanisms explaining how exchange rate fluctuations influence a country's export and import activities. Changes in exchange rates affect the relative prices of domestic goods compared to foreign goods, thereby directly influencing international trade competitiveness (Krugman & Obstfeld, 2009; Dornbusch, 1987). In the context of Indonesia as a developing economy that relies heavily on international trade, fluctuations in the Rupiah exchange rate play a crucial role in shaping the dynamics of national exports and imports. When the Rupiah depreciates, Indonesian export products become relatively cheaper in foreign markets when priced in foreign currency. This condition tends to stimulate international demand and subsequently increase export volumes. Conversely, depreciation raises the domestic prices of imported goods, leading to a decline in import demand. Through this mechanism, exchange rate depreciation theoretically improves the trade balance and contributes positively to economic growth through higher net exports (Bahmani-Oskooee & Hegerty, 2010). However, the impact of exchange rate movements on international trade is not always fully transmitted. In practice, changes in export and import prices often only partially reflect exchange rate adjustments. This phenomenon is commonly referred to as exchange rate pass-through, where exchange rate fluctuations are not completely translated into international trade prices (Campa & Goldberg, 2005). As a result, the relationship between exchange rates and export performance becomes more complex and requires an empirical approach capable of capturing both short-run and long-run dynamics.

Balance Sheet Channel. Apart from the trade channel, exchange rate movements may also influence the economy through the balance sheet channel. This mechanism explains that exchange rate depreciation can increase the burden of foreign currency-denominated debt held by domestic firms (Bernanke et al., 1999). When the Rupiah depreciates against the US dollar, the value of external debt obligations measured in domestic currency rises, potentially reducing firms' investment capacity.

Dominant Currency Paradigm (DCP). Over recent decades, the role of the US dollar as the dominant currency in international trade transactions has strengthened significantly. This phenomenon is known as the *Dominant Currency Paradigm* (DCP), whereby global trade prices are predominantly invoiced in US dollars rather than in the currencies of exporting or importing countries (Gopinath, 2015; Boz et al., 2017).

3. Research Method

To analyze the influence of exchange rates on Indonesia's exports and imports, this study adopts the methodology developed by Kearns and Patel (2016) using the AutoRegressive Distributed Lag (ARDL) model. The ARDL framework is particularly suitable because it allows

simultaneous estimation of short-term and long-term relationships and can be applied to variables integrated at different orders, namely I(0) and I(1) (Pesaran et al., 2001). The ARDL specification employed in this study is expressed as follows:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{n_1} \beta_1 \Delta y_{t-i} + \sum_{i=0}^{n_2} \beta_2 \Delta REER_{t-i} + \sum_{i=0}^{n_2} \beta_3 \Delta X_{t-i} + \gamma_0 y_{t-1} + \gamma_1 REER_{t-1} + \gamma_2 X_{t-1} + \varepsilon_t$$

In this equation, y_t represents Indonesia real export or import volume, while $REER_t$ denotes the *Real Effective Exchange Rate* (REER). The control variables X_t include global commodity prices, foreign demand for Indonesian exports, and domestic demand for imports. Meanwhile, ε_t represents the error term capturing other factors outside the model.

This study not only examines the linear relationship between exchange rates and trade performance but also investigates the possibility of asymmetric effects. Recent literature suggests that currency depreciation and appreciation may generate different responses in international trade (Shin et al., 2014; Bahmani-Oskooee & Aftab, 2018). For instance, Rupiah depreciation may stimulate exports more strongly than appreciation suppresses them. Therefore, this study employs the *Nonlinear Autoregressive Distributed Lag* (NARDL) model developed by Shin et al. (2014).

The NARDL framework allows exchange rate changes to be decomposed into positive and negative partial sums, enabling the identification of asymmetric effects in both the short and long run. The NARDL specification applied in this research is formulated as follows:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{n_1} \beta_1 \Delta y_{t-i} + \sum_{i=0}^{n_2} \beta_2 \Delta POS_{t-i} + \sum_{i=0}^{n_2} \beta_3 \Delta NEG_{t-i} + \sum_{i=0}^{n_2} \beta_4 \Delta X_{t-i} + \gamma_0 y_{t-1} + \gamma_1 POS_{t-1} + \gamma_2 NEG_{t-1} + \gamma_3 X_{t-1} + \varepsilon_t$$

Where :

$$POS_t = \sum_{j=1}^t \max(\Delta \ln(REER_j), 0), \quad NEG_t = \sum_{j=1}^t \min(\Delta \ln(REER_j), 0)$$

Through this approach, the study can identify whether exchange rate depreciation exerts a stronger influence on exports compared to appreciation. Nonlinearity testing is conducted using Ramsey's RESET Test to ensure the existence of nonlinear relationships among variables.

The key coefficients of interest are the interaction coefficients between exchange rates and trade volumes. Since an increase in REER reflects domestic currency depreciation, the expected coefficient for exports is positive, whereas the expected coefficient for imports is negative. This implies that a weaker Rupiah is expected to stimulate exports and reduce imports, thereby improving Indonesia's net exports.

Prior to estimation, Unit Root Tests are conducted to examine the stationarity properties of all variables. Subsequently, a Bounds Test is performed to identify long-run cointegration relationships before estimating the ARDL and NARDL models. The estimations are carried out for both aggregate exports and imports as well as for major export and import commodity groups.

The study employs quarterly macroeconomic data for Indonesia covering the period from 2004 to 2019. Real export and import data as dependent variables are obtained from publications issued by Badan Pusat Statistik, while commodity-level export and import data are sourced from Bank Indonesia. Export commodities are classified into non-oil and gas sectors, including agriculture, mining, and manufacturing. Meanwhile, imports are categorized into consumer goods, raw materials, and capital goods. The use of sectoral data aims to provide a more comprehensive understanding of the sensitivity of different commodity groups to exchange rate fluctuations.

To measure the impact of exchange rates on corporate investment through the balance sheet channel, this study adopts the models developed by Bleakley and Cowan (2002) and Sahminan (2006). The estimated equation is specified as follows:

$$Y_{i,t} = \alpha(D_{i,t-1}^* \times \Delta e_t) + \beta D_{i,t-1}^* + \gamma \Delta e_t + \delta D_{i,t-1} + \varphi X_t + \varepsilon_{i,t}$$

In this equation, $Y_{i,t}$ represents corporate investment proxied by changes in current assets and capital expenditure. The variable Δe_t denotes changes in the Rupiah exchange rate against the US dollar, while $D_{i,t-1}^*$ represents firms' net foreign currency debt. The control variables X_t include investment loan interest rates and other macroeconomic indicators.

The primary coefficient of interest is the interaction between foreign currency debt and exchange rate fluctuations. A negative coefficient indicates the dominance of the balance sheet effect, where currency depreciation reduces investment due to the rising burden of external debt. Conversely, a positive coefficient reflects the dominance of the competitiveness effect, whereby firms benefit from higher export revenues resulting from currency depreciation.

This study utilizes audited financial statements from 129 non-financial companies conducting *Initial Public Offerings* (IPO) during the period 2017–2020. The selected observation period ensures balanced panel data and reflects recent conditions characterized by the increasing external debt exposure of Indonesian corporations. Panel regression estimation is conducted using both fixed effect and random effect approaches, with model selection determined through the Hausman Test.

This study employs a panel data estimation approach to analyze the DCP phenomenon and its implications for changes in Indonesia's export volume to major trading partner countries. The analytical framework follows the methodology developed by Boz et al. (2017), specified as follows:

$$\Delta y_{ij,t} = \lambda_{ij} + \delta_t + \sum_{k=0}^4 \alpha_k \Delta e_{ij,t-k} + \theta' X_{j,t} + \varepsilon_{ij,t}$$

And

$$\Delta y_{ij,t} = \lambda_{ij} + \delta_t + \sum_{k=0}^4 \alpha_k \Delta e_{ij,t-k} + \sum_{k=0}^4 \beta_k \Delta e_{\$,j,t-k} + \theta' X_{j,t} + \varepsilon_{ij,t}$$

In these equations, $\Delta y_{ij,t}$ denotes the logarithmic growth of bilateral trade volume, while $\varepsilon_{ij,t}$ represents the bilateral exchange rate between Indonesia and its trading partners.

The variable $\varepsilon_{\$j,t}$ to the Rupiah exchange rate against the US dollar.

The main hypothesis of this study states that if the coefficient β_k is statistically significant and larger than α_k , then the Rupiah exchange rate against the US dollar exerts a more dominant influence on Indonesia's export volume compared to bilateral exchange rates. Such findings would provide empirical support for the existence of the DCP phenomenon in Indonesia's international trade activities.

The study uses secondary data obtained from Bank Indonesia, Bloomberg, Badan Pusat Statistik, and National Bureau of Economic Research. The dataset covers quarterly observations from 2006 to 2019 and includes nine major trading partners of Indonesia, namely China, Japan, Singapore, India, Malaysia, South Korea, the Philippines, Thailand, and Vietnam.

As part of its contribution, this study also constructs an export volume index following the methodology proposed by Boz et al. (2017), formulated as follows:

$$Volume\ Indices_{xy,t} = \left(\frac{X_{volume_{xy,t}}}{X_{volume_{xy,t_0}}} \right) \times 100$$

The export volume index is employed to measure changes in Indonesia's trade volume with major trading partners using 2018 as the base year, consistent with official publications from BPS. This approach enables the study to provide a more comprehensive understanding of the sensitivity of Indonesia's exports to exchange rate fluctuations and the growing dominance of the US dollar in international trade.

4. Finding and Discussion

4.1 Trade Channel

The correlation between the real exchange rate (REER) and Indonesia's export performance appears relatively weak when observed over the entire study period from 2004 to 2024. As illustrated in Figure 1, the correlation coefficient between real exports and the real exchange rate is recorded at -0.37, indicating a modest inverse relationship between the two variables. This finding suggests that exchange rate movements alone are not sufficient to explain fluctuations in Indonesia's export performance. In several periods, export growth did not respond proportionally to changes in the exchange rate, implying that external demand conditions, global commodity prices, production capacity, and international trade dynamics may have played a more dominant role in shaping export outcomes.

However, a different pattern emerges when the analysis focuses on the post-2010 period. The graphical trend shows a stronger synchronization between export performance and exchange rate movements, reflected by a positive correlation coefficient of 0.61. This result indicates that a depreciation of the rupiah, represented by a decline in the REER, tends to be associated with higher export performance. Such a pattern is consistent with conventional international trade theory, which argues that currency depreciation improves the price competitiveness of domestic products in international markets, thereby stimulating export demand (Krugman, Obstfeld, & Melitz, 2018). The stronger relationship observed after 2010 may also reflect Indonesia's

increasing integration into global value chains and the growing responsiveness of export-oriented industries to exchange rate incentives.

The import channel exhibits a similar but inverse relationship. Figure 2 illustrates that the correlation between real imports and the real exchange rate is -0.35, signifying that exchange rate depreciation is generally associated with reduced import levels. This finding aligns with economic theory, as a weaker domestic currency elevates the cost of imported goods and diminishes import demand (Salvatore, 2020). Nonetheless, the relatively low magnitude of the correlation suggests that import activity is influenced not only by exchange rate fluctuations but also by domestic economic growth, industrial demand for imported intermediate goods, investment activity, and alterations in global market conditions.

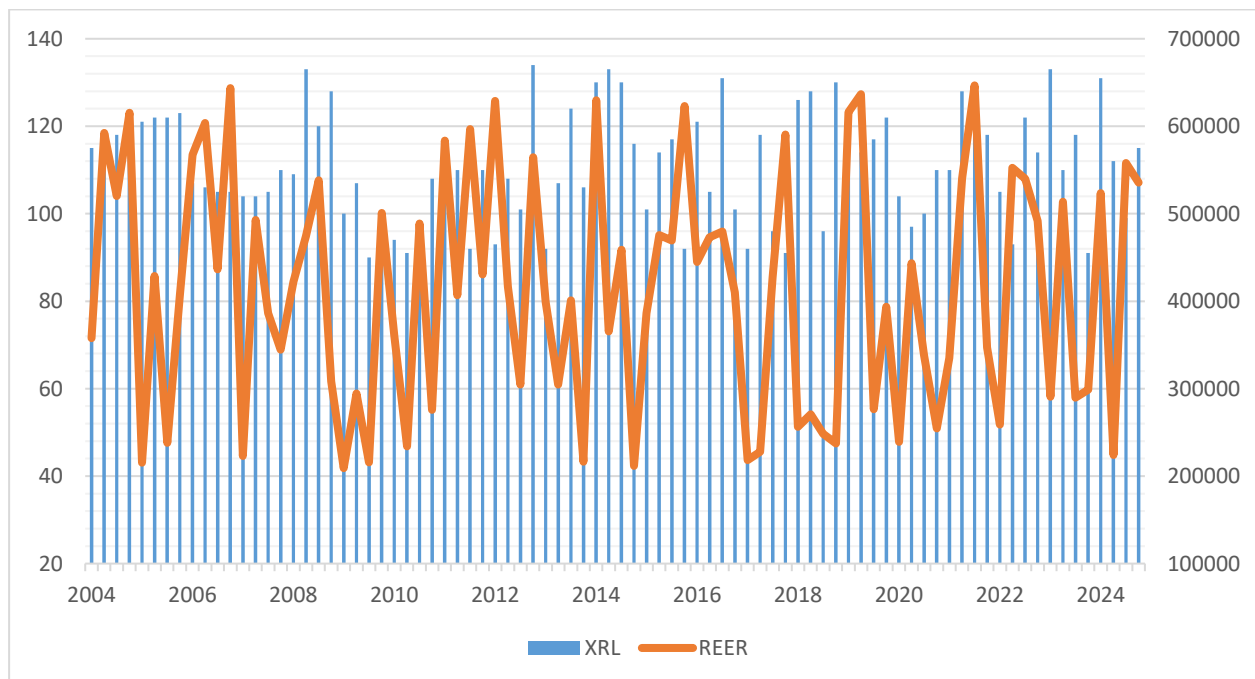


Figure 1. Real Exports at Real ERs

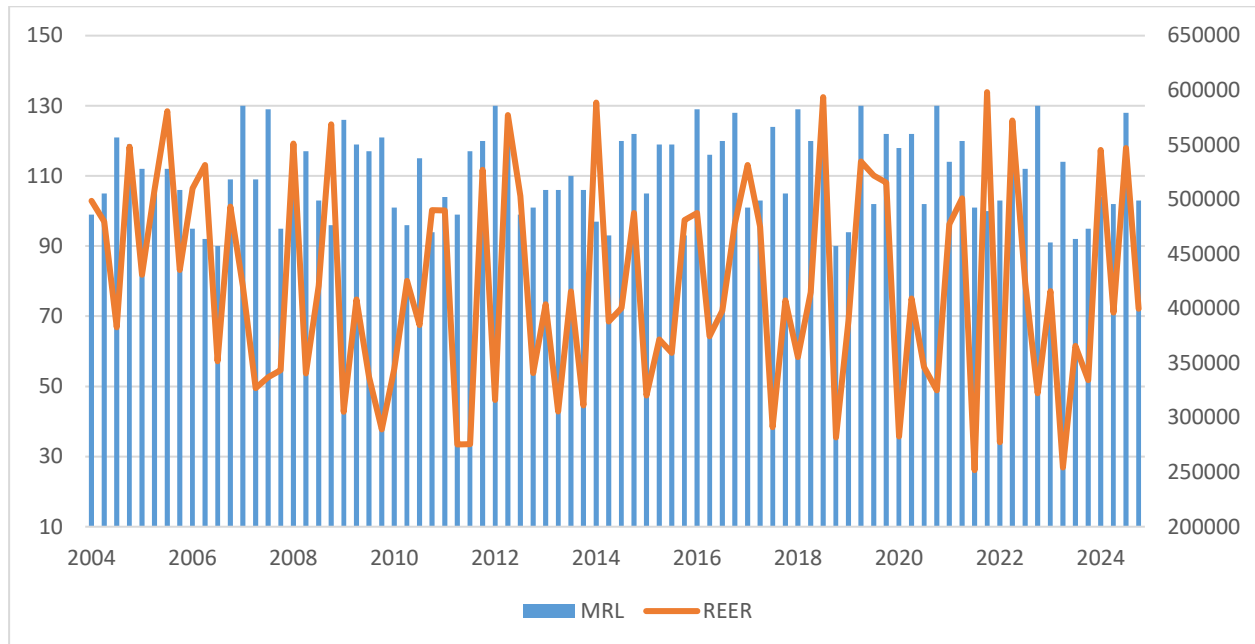


Figure 2. Real Imports with Real ERs

The stationarity assessment reveals that all variables meet the essential conditions for ARDL estimation. Notably, the real exchange rate variable exhibits stationarity in levels within both the export and import specifications. Conversely, variables such as real exports, real imports, commodity prices, domestic prices, domestic demand, and world GDP attain stationarity after first differencing. The coexistence of $I(0)$ and $I(1)$ variables, in conjunction with the absence of any $I(2)$ series, substantiates the suitability of employing the ARDL methodology to investigate the long-term and short-term relationships among the variables.

Table 1. Stationary Test Results For Export Model Variables

Variable	LEVEL	1 st Difference
Export	0,7243	0,0000
REER	0,0534	0,0000
GDP	1,1302	0,0345
IHKEI	0,0742	0,0000

All export-related variables are stationary at the first difference ($I(1)$) with $\alpha=5\%$.

Table 2. Stationary Test Results For Import Model Variables

Variable	LEVEL	1 st Difference
Import	0,5427	0,0180
Export	0,7243	0,0000
REER	0,0534	0,0000
GDP	1,1302	0,0345
IHKEI	0,0742	0,0000
Domestic Demand	1,0000	0,0840

All import-related variables are stationary at the first difference (I(1)) with $\alpha=5\%$.

The Bound Test results for cointegration in both the export and import equations indicate the existence of a long-run equilibrium relationship between the real effective exchange rate (REER) and Indonesia's international trade performance. This finding is supported by the error correction terms (ECT), which are negative and statistically significant at the 1% level for both export (-0.555) and import (-0.840) models. The negative and significant ECT coefficients confirm that deviations from long-run equilibrium are corrected over time, with approximately 55.5% of export disequilibrium and 84.0% of import disequilibrium being adjusted within one quarter.

The long-run estimation results reveal that the real effective exchange rate significantly affects both exports and imports. Specifically, the REER coefficient is positive and significant in the export equation (0.570), indicating that exchange rate movements contribute positively to Indonesia's export performance. Conversely, the coefficient is negative and significant in the import equation (-0.525), suggesting that exchange rate depreciation reduces import demand in the long run. These findings imply that exchange rate fluctuations play a crucial role in determining Indonesia's trade flows.

In addition to exchange rate effects, global economic conditions represented by World GDP exert a positive and statistically significant influence on exports (0.921). This result suggests that stronger global economic activity increases international demand for Indonesian products. Similarly, the Indonesian Export Commodity Price Index (IHKEI) positively affects exports (0.723), indicating that higher global commodity prices enhance Indonesia's export earnings. On the import side, IHKEI exhibits a negative coefficient (-0.565), reflecting that increases in commodity prices may reduce import demand due to higher production costs or adjustments in domestic consumption patterns.

Domestic demand is found to be a major determinant of imports, with a positive and highly significant coefficient of 1.542. This result indicates that increases in domestic consumption and investment stimulate the demand for imported goods and intermediate inputs. Furthermore, exports positively influence imports (1.232), reflecting the dependence of export-oriented industries on imported raw materials, capital goods, and intermediate products.

Regarding the short-run dynamics, the impact of exchange rate movements is relatively weaker compared with the long-run effects. The contemporaneous REER coefficient in the export

model is positive and significant (0.321), indicating that exchange rate changes immediately affect export performance. However, no significant short-run effect is observed in the import equation for the contemporaneous REER coefficient (-0.222). Instead, imports respond significantly to exchange rate changes after two quarters, as indicated by the positive and significant lagged coefficient $REER_{t-2}$ (0.720). This delayed response suggests that import adjustment processes require time due to existing contracts, production planning, and inventory management.

Table 3. ARDL Linear Model Estimation Results

Description	Export	Import
Error correction term	-0.555***	-0.840***
REER	0.570**	-0.525**
GDP	0.921***	
IHKEI	0.723***	-0.565**
Domestic Demand		1.542***
Export		1.232***
$REER_{t-2}$		0.332
$REER_{t-1}$		0.720***
$REER_t$	0.321*	-0.222
ARDL	3,1,1,1	1,2,1,0,0
Adj R-squared		
T test	-0.231	-13.748
F test	0.967	48.543
LM test	0.832	0.882

Table 4. Simulation of 1% Depreciation in the Long Run (ARDL Model)

Variable	Long term Elasticity	Contribution
Export	0.642	0.15%
Import	-0.543	-0.17%

In the long run, the estimated coefficient of the real exchange rate on total exports is 0.642, implying that a 1% depreciation in the real exchange rate is associated with a 0.64% increase in export volume, assuming other factors remain constant. Conversely, the coefficient for total imports is -0.543, suggesting that a 1% depreciation leads to a 0.54% decrease in imports. Utilizing the average export and import shares of GDP during the period 2010–2022, which amounted to 32.73% and 31.65%, respectively, a 1% depreciation of the real exchange rate is estimated to enhance overall economic performance through increased net exports, resulting in an additional 0.33% contribution to GDP (as depicted in Table 4). This positive effect is attributed to the rise in exports, which contributes approximately 0.12% to GDP, in conjunction with the reduction in imports, which contributes around 0.10%. Conversely, a 1% appreciation of the real exchange rate is anticipated to yield an equivalent adverse effect, leading to a reduction in GDP by approximately 0.33%. These findings align with the Marshall–Lerner

condition, indicating that exchange rate depreciation can strengthen the trade balance and support economic growth.

The cointegration test results based on the nonlinear ARDL (NARDL) framework indicate the existence of a long-run relationship between the real exchange rate and both exports and imports. This conclusion is supported by the significance of the error correction terms, which are negative and statistically significant at the 1% level for both export (-0.735) and import (-0.920) equations. The magnitude of these coefficients suggests that approximately 73.5% and 92.0% of short-run disequilibria are corrected within one period in the export and import models, respectively.

The long-run estimation results reveal an asymmetric impact of exchange rate movements on Indonesia's trade performance. Specifically, a depreciation of the real exchange rate (REEPOS) exerts a positive and statistically significant effect on exports, with a coefficient of 0.834, indicating that a 1% depreciation increases export performance by approximately 0.83%, *ceteris paribus*. Conversely, depreciation reduces imports, as reflected by the negative coefficient of -0.621, implying that a 1% depreciation lowers imports by approximately 0.62%.

On the other hand, the appreciation component of the exchange rate (REERNEG) also exhibits asymmetry. A 1% appreciation is associated with a 0.62% decline in exports, while its effect on imports is statistically insignificant, as indicated by the coefficient of 0.112. These findings suggest that exchange rate depreciation has a stronger influence on trade flows than appreciation, particularly in the export sector. Such evidence supports the asymmetric adjustment mechanism proposed in the NARDL framework.

Furthermore, external demand conditions, represented by global GDP, have a positive and significant impact on exports, with a coefficient of 0.761. This indicates that stronger global economic activity stimulates Indonesia's export performance. Similarly, domestic demand significantly increases imports, as evidenced by the coefficient of 1.249. The positive and significant coefficient of exports in the import equation (1.233) reflects the high import content embedded in export production activities. In the short run, the asymmetric effects of exchange rate changes remain evident. Depreciation exerts a significant influence on imports, while appreciation has a relatively weaker and statistically insignificant effect. Overall, the results suggest that exchange rate depreciation generates a more pronounced response in trade flows than appreciation, both in the short and long run.

Table 6 presents the simulation of a 1% variation in the real exchange rate on net exports, utilizing the estimated long-run elasticities derived from the NARDL model. Depreciation and appreciation scenarios exhibit notable asymmetry. Under a 1% depreciation scenario (Panel A), exports experience an increase of 0.845%, contributing 0.19% to economic activity, while imports decrease by 0.647%, resulting in a negative contribution of -0.15%. Consequently, net exports improve by 0.34%, indicating that depreciation enhances economic performance through a more favorable trade balance. Conversely, under a 1% appreciation scenario (Panel B), exports decline by 0.670%, whereas imports increase by 0.141%. Despite maintaining a positive net export figure of 0.24%, the magnitude is smaller compared to that observed under

depreciation. This observation corroborates the asymmetric nature of exchange rate movements, wherein depreciation induces a more pronounced adjustment in trade flows and contributes a greater impact on economic performance than appreciation.

Table 5. Non-Linear ARDL Model Estimation Results

Description	Export	Import
Error correction term	-0.735***	-0.920***
<i>Long-term Coefficient</i>		
REEPOS	0.834***	-0.621**
REERNEG	0.620**	0.112
INKEI	0.612***	-0.089
GDP	0.761**	
Domestic Demand		1.249***
Export		1.233***
<i>Short-term Coefficient</i>		
REEPOS _{t-2}		1.203***
REEPOS _{t-1}	-1.333***	0.112
REEPOS _t	0.322	-0.933***
REERNEG _{t-1}	0.140	
REERNEG _t	0.035	0.761
ARDL	1,4,4,4,4	1,5,2,5,2
Adj R-squared	0.997	0.993
T test	-0.220	-0.920
F test	12.2213	19.542
LM test	0.234	0.523

The asterisks ***, **, * indicates the significant level at $\alpha = 1\%$, $\alpha = 5\%$; $\alpha = 10\%$ respectively.

Table 6. Simulation of 1% Real ER Change on the Long Run (NADL Model)

The simulation of the ER's impact on the economy through export and import using long-term elasticity shows asymmetric effects when depreciating and appreciating.

Variable	Long term Elasticity	Contribution	Net Export
Panel A :			
Export	0.845	0.19%	
Import	-0.647	-0.15%	0.34%
Panel B :			
Export	0.670	0.15%	
Import	-0.141	-0,09%	0.24%

4.2 Commodity Export-Import Estimation Results

This section examines the impact of exchange rate fluctuations on Indonesia's export and

import activities using both linear and nonlinear models. Prior to model estimation, stationarity tests were conducted to ensure that the variables meet the ARDL framework's requirements. The results presented in Tables 1 and 2 indicate that all variables are integrated at either $I(0)$ or $I(1)$, validating the suitability of the ARDL approach for analyzing both short-run dynamics and long-run relationships.

The presence of a long-run relationship between exchange rates and trade performance is corroborated by the Bound Test results. As depicted in Table 3, the error correction terms exhibit negative values and statistical significance in both the export and import equations. This finding implies that any short-run deviation from equilibrium is gradually rectified over time, suggesting that exports and imports adjust towards their long-run trajectories following exchange rate shocks.

The long-run estimates reveal that exchange rate movements continue to be a significant determinant of Indonesia's trade performance. A depreciation of the rupiah is associated with enhanced export performance and reduced import demand. The positive coefficient of the real effective exchange rate (REER) in the export equation and the negative coefficient in the import equation, as illustrated in Table 3, align with conventional trade theory. When the domestic currency weakens, Indonesian products become comparatively more competitive in international markets, while imported goods become more expensive for domestic consumers and producers.

The estimation results underscore the significance of external and domestic demand conditions. Global economic activity, represented by World GDP, positively influences export performance, reflecting Indonesia's reliance on foreign demand. Similarly, fluctuations in international commodity prices support export growth, particularly considering the substantial role of commodity-based products in Indonesia's export structure. On the import side, domestic demand appears to be the primary driving force. The robust positive coefficient reported in Table 3 suggests that rising consumption and investment activities increase the demand for imported goods, intermediate inputs, and production materials. The positive correlation between exports and imports further indicates that a substantial portion of Indonesia's export production still relies on imported components and raw materials. While the linear model provides valuable evidence, exchange rate movements do not always generate proportional responses. Exporters and importers may react differently when the rupiah depreciates compared to when it appreciates. To capture this possibility, the nonlinear ARDL (NARDL) model was estimated. The Ramsey RESET test rejects the assumption of linearity, implying that a nonlinear specification is more appropriate for describing the relationship between exchange rates and trade flows.

The NARDL results reported in Table 5 reveal a clear asymmetry in the manner in which trade responds to exchange rate fluctuations. Depreciation of the rupiah produces a stronger effect than appreciation, particularly in the export sector. The long-run coefficient of the depreciation component (REEPOS) indicates that a 1% depreciation increases exports by approximately 0.83%, while simultaneously reducing imports by around 0.62%. These findings suggest that

exchange rate depreciation enhances Indonesia's external position through two channels: expanding exports and compressing imports.

The response to appreciation is considerably weaker. While appreciation reduces export performance, its impact on imports is statistically insignificant. This result implies that exporters are more responsive to gains in price competitiveness resulting from depreciation than they are to losses arising from appreciation. Such behavior is consistent with the characteristics of export-oriented industries, where firms often expand production when exchange rate conditions become favorable but may be slower to adjust when competitiveness deteriorates. A similar pattern emerges on the import side. The negative and significant coefficient associated with depreciation indicates that higher import costs discourage import demand. In contrast, appreciation does not generate a comparable increase in imports. One possible explanation is that a large share of Indonesia's imports consists of essential raw materials and intermediate goods that cannot easily be substituted, making import demand relatively less responsive to exchange rate appreciation.

The economic implications of these asymmetric responses become more evident in the simulation results presented in Table 6. A 1% depreciation of the real exchange rate is estimated to increase exports by 0.845% while reducing imports by 0.647%. Consequently, these adjustments enhance net exports by approximately 0.34%. This outcome suggests that exchange rate depreciation positively contributes to economic activity by strengthening the trade balance. In contrast, the effects of appreciation are notably smaller. Although export performance declines following appreciation, the response of imports remains limited, resulting in a weaker overall impact on net exports. The disparity between the depreciation and appreciation scenarios reinforces the conclusion that exchange rate effects are inherently asymmetric and that depreciation generates a substantially larger adjustment in trade flows. In summary, the evidence from Tables 3, 5, and 6 indicates that exchange rate movements continue to play a significant role in shaping Indonesia's trade performance. More importantly, the results suggest that the benefits of depreciation are considerably larger than the adverse effects of appreciation. These findings support the view that maintaining external competitiveness remains essential for sustaining export growth, reducing import dependence, and strengthening Indonesia's trade balance in the long term.

Table 7. Investment Equation Test Results

Variable	Δ Random Effect (Current Asset)	Δ Random Effect (Fix Asset)	Capex TA Random Effet	Capex TA Fix Effect
Net Foreign Currency (-1) * Δ ER	0.22*	-0.24	-0.05	0.05
Net Foreign Currency (-1)	0.11	0.13	0.002	0.007
Δ ER	0.21***	0.19***	0.04	0.04

Δ Domestic Debt	0.25***	0.29***	0.02**	0.01
Interest rate (-1)	-0.11***	-0.11***	-0.03	-0.015
Constant	0.55***	0.42***	0.13`	0.12***

Net Foreign Currency * Δ ER is an interaction variable between the company's debt position minus assets in foreign currency multiplied by changes in the ER. The higher the ER indicates the depreciation of the ER. Domestic Debt is the company's debt position in rupiah. The interest rate is the investment loan interest rate. Estimates are made using two dependent variables, namely changes in current assets per total assets and capital expenditure per total assets. The two dependent variables are then estimated using random and fixed effects. ***, **, and * signify significance level at 1%, 5%, and 10%, respectively.

The test results demonstrate consistency when employing an alternative endogenous variable, namely capital expenditure. The interaction coefficient between net foreign currency debt and fluctuations in exchange rates is negative, although not statistically significant, at -0.05 in the random effects model. The negative sign is also derived from testing with fixed or random effects. Simultaneously, other variables exhibit the same sign as the test outcomes utilizing existing assets as endogenous variables. To assess the effect of a 1% depreciation in the exchange rate, the equations proposed by Bleakley and Cowan (2002) and Sahminan (2006) must be formulated regarding the exchange rate as follows:

$$\frac{\partial Y_{i,t}}{\partial \Delta e_t} = \alpha(D_{i,t-1}^*) + \gamma \quad \text{it could be written as follows:} \quad \frac{\partial Y_{i,t}}{\partial \Delta e_t} = 0.22(D_{i,t-1}^*) + 0.21$$

Based on the random-effects estimation, the relationship can be expressed by Equation (7). Substituting the median value of net foreign currency debt (D^*), which accounts for 6.5% of total assets, indicates that a 1% depreciation of the exchange rate is associated with a 0.11% decline in firms' current assets. This estimated impact is lower than that reported by Sahminan (2006), who found that a 1% depreciation led to a 2.1% reduction in current assets. The relatively smaller effect observed in this study may be attributed to changes in corporate financial structures during the sample period. In particular, firms included in the more recent observations held lower levels of foreign currency-denominated debt, thereby reducing their vulnerability to exchange rate fluctuations through the balance-sheet channel. Consequently, the adverse consequences of currency depreciation on corporate financial positions appear less pronounced than those documented in earlier studies. When the time-varying measure of net foreign currency debt is employed, as presented in Table 8, the estimated impact of a 1% depreciation in the exchange rate changes accordingly, reflecting differences in firms' exposure to foreign currency liabilities over time.

Table 8. Variations in Net Foreign Currency Debt and the Impact of ER Depreciation

Year	Net Foreign Currency Debt	Impact of i% Depreciation on Investment
2020	7.3%	-0.97%
2021	6.8%	-0.96%
2022	6.2%	-0.77%
2023	2.8%	0.29%

In column (1), net foreign currency debt is defined as the average debt position minus the assets denominated in foreign currencies within the sample for each year. The impact of a 1% depreciation on investment is determined using equation (7) for each net foreign currency debt position per year.

These findings suggest that the impact of exchange rate depreciation on firms' current assets largely depends on the extent of their exposure to foreign currency liabilities. In other words, the balance-sheet effect becomes stronger as the proportion of net foreign currency debt increases. The estimated nonlinear model indicates that exchange rate depreciation does not necessarily harm corporate financial conditions. For firms with relatively low levels of foreign currency debt, depreciation may even contribute positively to investment performance by improving export competitiveness and increasing revenue. However, this positive effect only persists up to a certain level of foreign currency exposure. Beyond a specific threshold, the burden arising from higher debt-servicing costs outweighs the competitiveness gains generated by depreciation. Using the estimated coefficients, the threshold value of net foreign currency debt ($D^*_{i,t-1}$) is calculated at -0.95%. This result implies that when the ratio of net foreign currency debt is below -0.95%, exchange rate depreciation is expected to have a favorable effect on changes in current assets. Conversely, once the ratio reaches or exceeds -0.95%, the balance-sheet effect becomes dominant, causing depreciation to negatively affect firms' current assets. This evidence highlights the importance of maintaining prudent foreign currency debt management. Firms with limited exposure to foreign currency liabilities are more likely to benefit from exchange rate depreciation, whereas highly leveraged firms become increasingly vulnerable to adverse balance-sheet effects when the domestic currency weakens.

To assess the impact of a 1% exchange rate depreciation on investment performance ($\Delta I_{i,t}$) the analysis applies the Two-Stage Least Squares (TSLS) estimation approach based on the following specification:

$$\Delta I_{i,t} = \alpha_1 (\Delta \widehat{CA/TA}_{i,t}) + \varepsilon_{i,t}$$

$$\Delta \widehat{CA/TA}_{i,t} = \alpha (D^*_{i,t-1} \times \Delta e_t) + \beta D^*_{i,t-1} + \gamma \Delta e_t + \delta D_{i,t-1} + \varphi X_t + \varepsilon_{i,t}$$

The estimation results presented in Table 9 reveal a positive and statistically significant correlation between changes in current assets and investment. Using the random-effects specification, the estimated coefficient of current assets is 0.43, indicating that improvements in firms' liquidity positions are associated with increased investment levels. The fixed-effects

estimation yields a slightly lower coefficient of 0.33, but the positive relationship remains statistically significant, demonstrating the robustness of the results across different estimation methods. The magnitude of the coefficient suggests that changes in current assets play a crucial role in influencing corporate investment decisions. Firms with an increase in current assets tend to have greater financial flexibility, enabling them to expand investment activities more easily. Conversely, a decline in current assets may restrict firms' ability to finance new investments, especially when access to external financing is limited. By combining the estimated balance-sheet effect with the investment equation, we can gain insights into the overall impact of exchange rate depreciation on investment. Based on the random-effects estimation, a 1% depreciation of the exchange rate is estimated to reduce current assets by approximately 0.6%. Considering the estimated coefficient of 0.43 reported in Table 9, the indirect effect of exchange rate depreciation on investment is approximately -0.26% ($-0.60 \times 0.43 = -0.258$). This finding suggests that exchange rate depreciation can negatively impact investment through its influence on firms' balance sheets, although the extent of this effect depends on the level of firms' exposure to foreign currency liabilities.

Table 9. Results of estimated impact of current assets changes on investment

Variable	Random Effect	Fixed Effect
Δ Current Assets	0.43***	0.33***
Constant	1.80***	1.79***

Estimation of the change in current assets per total asset to investment in GDP.

4.3 Estimation Results: Sector Analysis

To further investigate the transmission of exchange rate movements across economic activities, this study assesses the impact of exchange rate depreciation on investment at the sectoral level. The estimates are derived from Equation (7) by combining the aggregate coefficient obtained from the random-effects model with the average level of net foreign currency debt in each sector. The results are presented in Table 11. The findings reveal substantial variation in the response of investment to exchange rate depreciation across sectors. Sectors with relatively high exposure to foreign currency liabilities tend to experience a stronger balance-sheet effect, resulting in a larger decline in investment when the domestic currency depreciates. Conversely, sectors with lower foreign currency exposure appear to be less vulnerable and, in some cases, even benefit from exchange rate movements.

As shown in Table 10, the agricultural sector experiences the largest adverse impact, with investment declining by approximately 4.22% following a 1% depreciation of the exchange rate. A similarly strong negative response is observed in the communication sector (-2.45%) and the mining sector (-1.33%). These sectors are likely to face greater pressure from exchange rate depreciation due to their dependence on imported capital goods, technology, or foreign currency-denominated financing. As the domestic currency weakens, the cost of servicing foreign liabilities increases, reducing firms' capacity to undertake new investment. Negative investment responses are also observed in the transportation sector (-0.75%) and utilities sector

(-0.52%). The relatively high capital intensity of these sectors may explain their sensitivity to exchange rate fluctuations, particularly when investment activities rely on imported equipment and foreign financing. Manufacturing also records a slightly negative effect (-0.08%), suggesting that the adverse balance-sheet effect broadly offsets the potential competitiveness gains associated with a weaker exchange rate.

In contrast, several sectors exhibit positive investment responses following exchange rate depreciation. The construction sector records the highest positive effect (0.21%), followed by real estate (0.20%), health services (0.19%), hotel and accommodation services (0.15%), and trade (0.07%). These findings suggest that firms operating in these sectors are either less exposed to foreign currency liabilities or are able to benefit from increased domestic demand and improved competitiveness arising from exchange rate adjustments.

The sectoral differences reported in Table 10 highlight the heterogeneous nature of exchange rate transmission within the economy. While depreciation may stimulate economic activity in sectors with limited foreign currency exposure, it can simultaneously constrain investment in sectors that rely heavily on external financing. Consequently, the overall impact of exchange rate depreciation depends not only on the magnitude of the exchange rate shock itself but also on the financial structure and foreign currency exposure of each sector. These results support the balance-sheet channel hypothesis, which argues that exchange rate depreciation can weaken firms' financial positions when foreign currency liabilities are substantial. At the same time, the findings demonstrate that the magnitude of this effect is not uniform across sectors. Therefore, policies aimed at reducing excessive foreign currency exposure and strengthening risk-management practices may help mitigate the adverse investment effects of exchange rate volatility, particularly in sectors that are highly dependent on external financing.

Table 10. Investment Equation Test Result: Sector Analysis

No	Sector	Impact of ER (Change on Investment %)
1	Real Estate	0.20
2	Manufacturing	-0.08
3	Construction	0.21
4	Communication	-2.45
5	Health	0.19
6	Mining	-1.33
7	Utilites	-0.52
8	Trade	0.07
9	Transportation	-0.75
10	Hotel	0.15
11	Agriculture	-4.22

The impact of ER changes on investment can be calculated using equation (7), considering the average foreign currency debt in each sector.

4.3 Dominant Currency Paradigm

Indonesia's primary commercial partners are predominantly Asian nations. However, the majority of transaction settlements occur in the prevailing currency (non-Asian currencies). Approximately 70% of Indonesia's trade is conducted with Asian nations, including China, Japan, Singapore, India, Malaysia, South Korea, Thailand, and the Philippines. Conversely, commerce with the United States and Europe was significantly lower. The utilization of local currencies is constrained, as over 80% of export transaction settlements are conducted in US dollars, and more than 60% for import transactions. Prior to estimating the equations, a unit root test is conducted to assess the stationarity of each variable. The findings in Table 11 indicate that all variables exhibit stationarity, with the majority expressed in delta log form.

Table 11. Unit Root Test Results

Variabel	Variabel Name	PValue
Δ Log Bilateral Export Volume	DL_XVOL	0.000
Δ LOG Bilateral ER	DL_ER	0.000
Δ Log US\$ to IDR ER	DL_US\$	0.000
Δ Log Indonesia GDP	DL_IDRGDP	0.000
Δ GDP Growth	DL_GrowthGDP	0.000
Δ Log Volatility Index / VIX	DLVIX	0.000
Dummy Global Finance	DUMGFC	0.000
Quartal Period	Q12004 to Q42024	
Number of Observation	84	

Table shows stationary test results; all variables stationary at first difference with $\alpha=5\%$.

5. Conclusion

This study examines the influence of exchange rate fluctuations on Indonesia's economic performance through three primary transmission mechanisms: the trade channel, the balance sheet channel, and the Dominant Currency Paradigm (DCP). By employing ARDL and NARDL estimations in conjunction with firm-level and sectoral analyses, the study provides a comprehensive assessment of how exchange rate volatility impacts exports, imports, and investment decisions within the Indonesian economy.

The findings from the trade channel analysis indicate that exchange rate movements continue to be a significant determinant of Indonesia's external sector performance. The linear ARDL estimation corroborates that rupiah depreciation positively contributes to export growth while simultaneously mitigating import demand in the long term. These results suggest that exchange rate depreciation enhances Indonesia's trade balance by bolstering the international competitiveness of domestic products and elevating the relative cost of imported goods. Furthermore, the nonlinear ARDL model reveals that the response of trade flows to exchange rate movements exhibits asymmetry. Depreciation generates a substantially more pronounced

impact on exports and imports than appreciation, implying that exchange rate adjustments do not influence trade performance proportionally. This evidence underscores the significance of considering nonlinear dynamics when evaluating exchange rate policies and their implications for economic growth.

Although exchange rate depreciation may appear advantageous from a trade perspective, a balance sheet analysis reveals that its effects are not uniformly positive across economic agents. Firm-level estimations indicate that depreciation increases the burden of foreign currency-denominated liabilities, thereby weakening corporate financial positions. As foreign currency debt rises, the balance sheet effect becomes more pronounced, reducing firms' current assets and limiting their capacity to undertake new investments. Although the estimated adverse effect is smaller than that documented in earlier studies, the results nonetheless confirm that exchange rate depreciation can create financial vulnerabilities for firms that heavily rely on external financing. Consequently, the overall impact of exchange rate movements is not solely determined by changes in trade competitiveness but also by the financial structure of individual firms.

The sectoral analysis further reinforces this conclusion by revealing substantial heterogeneity in the transmission of exchange rate shocks across industries. Sectors with relatively high exposure to foreign currency liabilities, such as agriculture, communication, mining, transportation, and utilities, experience the most pronounced decline in investment following exchange rate depreciation. In contrast, sectors including construction, real estate, health services, hotels, and trade record positive investment responses, suggesting that competitiveness gains and domestic demand effects outweigh the adverse balance sheet consequences. These findings demonstrate that the economic effects of exchange rate movements are far from uniform and depend critically on sector-specific characteristics, particularly the extent of foreign currency exposure and financing structures.

Beyond the trade and investment channels, the study underscores the growing significance of the Dominant Currency Paradigm in Indonesia's international trade activities. Given that the majority of Indonesia's export transactions continue to be invoiced in US dollars, exchange rate fluctuations against the US dollar are likely to exert a more substantial influence on export performance than bilateral exchange rates with individual trading partners. This finding reflects the increasing dominance of the US dollar in global trade invoicing and emphasizes the importance of considering dollar exchange rate dynamics when evaluating Indonesia's external sector performance. Consequently, the results provide additional support for the argument that international trade outcomes in emerging economies are increasingly influenced by movements in dominant global currencies rather than solely by bilateral exchange rate adjustments.

In summary, the findings suggest that exchange rate depreciation can contribute positively to economic activity through enhanced net exports and improved external competitiveness. However, these benefits may be partially offset by adverse balance sheet effects, particularly among firms and sectors with substantial foreign currency liabilities. Consequently, the net economic impact of exchange rate movements depends on the interaction between trade gains

and financial vulnerabilities. This duality highlights the importance of adopting a balanced policy approach that not only supports external competitiveness but also strengthens corporate resilience to exchange rate shocks.

From a policy perspective, the results imply that maintaining exchange rate stability remains essential for sustaining Indonesia's long-term economic growth. Policies aimed at reducing excessive dependence on foreign currency debt, expanding the use of hedging instruments, and promoting local currency settlement in international trade could help mitigate the adverse consequences of exchange rate volatility. Simultaneously, efforts to strengthen export competitiveness and diversify export products remain crucial to maximize the benefits of exchange rate adjustments. By addressing both the trade and financial dimensions of exchange rate transmission, policymakers can enhance Indonesia's economic resilience and strengthen the sustainability of growth in an increasingly integrated global economy.

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